federal register

THURSDAY, OCTOBER 28, 1976

PART II:

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

■

AIRCRAFT NOISE MEASUREMENT AND EVALUATION SPECIFICATIONS

Proposed Rulemaking

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

[14 CFR Part 36]

[Docket No. 16221; Notice No. 76-21]

AIRCRAFT NOISE MEASUREMENT AND EVALUATION SPECIFICATIONS

Proposed Rule Making

The Federal Aviation Administration is considering amending Part 36 of the Federal Aviation Regulations (14 CFR Part 36) to amend the procedures and standards for conducting noise type certification and acoustical change tests contained in Appendices A and B, to revise the form by which certain standards and procedures are incorporated by reference in Part 36, to redesignate certain provisions, and to provide a table of sections in each Part 36 appendix.

Interested persons are invited to participate in the making of the proposed rule by submitting such written data, views, or arguments as they may desire. Communications should identify the regulatory docket or notice number and be submitted in duplicate to: Federal Aviation Administration, Office of the Chief Counsel, Attention: Rules Docket, AGC-24, 800 Independence Avenue SW., Washington, D.C. 20591. All communications received on or before December 30, 1976, will be considered by the Administrator before taking action on the proposed rule. The proposals contained in this notice may be changed in the light of comments received. All comments submitted will be available, both before and after the closing date for comments, in the Rules Docket for examination by interested persons.

Any person may obtain a copy of this Notice of Proposed Rule Making (NPRM) by submitting a request to the Federal Aviation Administration, Office of Public Affairs, Attention: Public Information Center, APA-430, 800 Independence Avenue, SW., Washington, D.C. 20591, or by calling (202) 426-8058. Communications must identify the notice number of this NPRM. Persons interested in being placed on a mailing list for future NPRMs should also request a copy of Advisory Circular No. 11-2 which describes the application procedure.

Background

Public Laws 90-411 and 92-574 were enacted to provide both present and future relief and protection to the public health and welfare from noise and sonic boom from civil aircraft. Under these Acts, the Administrator of the Federal Aviation Administration (FAA), after consultation with the Secretary of Transportation and the Administrator of the Environmental Protection Agency (EPA), is responsible for the adoption and amendment of rules which prescribe the necessary standards and regulations.

On November 3, 1969, the Federal Aviation Administration (FAA) adopted Part 36 of the Federal Aviation Regulations (FARs) entitled "Noise Standards: Aircraft Type Certification" (34 FR 18355; November 18, 1969). FAR Part 36 contains several appendices in which the technical specifications for demonstrating compliance with Part 36 are prescribed. Appendices A and B of FAR Part 36 contain the specifications for conducting noise type certification tests and for evaluating the noise data in terms of Effective Perceived Noise Level (EPNL). These appendices have been modified slightly since their adoption in 1969. Appendix C of Part 36 prescribes noise level limits for new designs of subsonic transport category and turbojet powered aircraft for which an application for type certificate was made on or after January 1, 1967. As adopted, Part 36 also contained provisions for preventing the escalation of noise levels regarding growth or follow-on versions of those types of aircraft in production and for which application for a type certificate was made prior to January 1, 1967. Subsequent amendments added Appendix F prescribing noise standards for propeller-driven small airplanes and amended provisions regarding limited new production of old, nonconforming aircraft types. The FAA currently has under consideration several other proposals including standards for other types of aircraft (SSTs, helicopters, STOLs, etc.) and for various aircraft operations and airport noise standards. Some of these proposals were submitted to the FAA by the EPA under the Noise Control Act of 1972.

This notice of proposed rule making (NPRM) proposed to adopt specific substantive and clarifying amendments in the test and analysis instrumentation specification, calibration procedures, meteorological test conditions, and data correction procedures. Procedural changes in the calculation of EPNL are also proposed. The FAA proposes to make these amendments applicable to FAR Part 36 noise certification tests made after March 31, 1977, or 30 days after publication of the final amendment, whichever occurs later.

Proposed Provisions

The proposed amendment to Appendix A involves a rather extensive revision which would be accomplished within the general framework of the current appendix. The FAA believes that some orgnizational revision is necessary to better accommodate the logical sequence of the expanded specifications. However, only relatively minor amendments are proposed for Appendix B. The FAA proposes editorial changes to redesignate certain provisions in Appendices A and B to conform with the format generally used throughout the FARs. To provide greater ease in identifying and citing the provisions in the appendices to Part 36, the FAA proposes to provide a "table of sections" at the beginning of the respective appendices and to designate the respective undesignated provisions of certain paragraphs and sections of Appendix B. Finally, the FAA proposes to amend Subpart A of Part 36 to add a new § 36.9 to prescribe the incorporations by reference contained in Part 36 under 5 U.S.C. 552(a) and 1 CFR Part 51 and to provide the required statements of identification and availability of incorporated published material. If this proposal is adopted, the present separate provisions in Appendices A, B, and F, which contain the required statements regarding incorporation by reference, would be revised.

The following discussion highlights portions of the proposed amendment to FAR Part 36:

A. Proposed Revised Appendix A

1. *Noise certification test and measurement conditions (proposed § A36.1).*— This section prescribes the conditions under which noise certification tests would be conducted and the measurement procedures that would be used to measure the noise made by the aircraft. These provisions would apply to tests conducted after March 31, 1977, or 30 days after publication of the final amendment, whichever occurs later.

The FAA proposes to prescribe in a single section all the requirements for an approved test site. While most of the provisions of this proposed section are already contained in Appendix A, it is felt that they should be grouped together. Additional requirements are proposed regarding an independent measurement of sideline noise if test site conditions make simultaneous takeoff and sideline measurements impractical.

A modification of the meteorological specification also is proposed. The temperature and relative humidity conditions under which testing is allowed would be amended to conform with proposed ICAO limits or to adopt a minor variation of the proposed ICAO limits. Basically, those ICAO limits would not allow testing when the sound attenuation rate in the one-third octave band centered at 8 kHz is greater than 10 dB/100 meters. However, the FAA is also considering adoption of a 12 dB/100 meters sound attenuation rate limit at the same frequency. This proposed alternative to the ICAO limit would be less restrictive than the ICAO proposal. Comments are specifically invited concerning the alternative proposals and the reasons why one sound attenuation rate would be preferable in the test meteorological specification. The ICAO proposed limits would also expand, under certain conditions, the permissible temperature range from the present 41-86 degrees F to 36-95 degrees F and the permissible relative humidity range from the present 30-90 percent to 20-95 percent. The FAA believes that amendments should be adopted that reflect current knowledge and state-of-the-art regarding calculation of atmospheric attenuation of sound energy. Based on its certification experience, the FAA believes that the current weather "window" is too restrictive of some combinations of temperatures and relative humidities while allowing some unsubstantiated corrections in other combinations. The FAA also proposes a new weather specification to require that the temperature and relative humidity to be within the "window" from the sur-

face measuring station to the altitude of the aircraft. More specific restrictions would be placed upon anomalous relative humidity and wind conditions. Each of these proposals grew out of FAA certification experiences and a need to provide regulatory guidance for use by the FAA regional authorities.

The FAA believes that to ensure the accuracy of noise level corrections under proposed § A36.11, the requirements for aircraft test weights should be amended to require the takeoff weight to be within five percent of the certification weight and the approach weight to exceed 90 percent of the maximum landing weight.

2. *Measurement of aircraft noise received on the ground (proposed § A33.6).*—The measurements prescribed in proposed § A36.3, like those in current § A36.2, provide the data for determining the one-third octave band noise produced by aircraft at specific observation stations, as a function of time. However, the instrumentation performance specifications have been significantly revised. These changes incorporate experience with actual certifications by both the FAA and ICAO over the past six years.

Three general guidelines were followed in the preparation of these proposals. First, the FAA intended to specify both systems and components that would give results with maximum accuracy and repeatability from test-to-test and site-to-site. Second, the proposals were prepared to avoid requiring instruments of any single brand name or manufacturer. Third, the specifications provide performance requirements that are generally measureable and verifiable in the field, rather than design parameters requiring sophisticated laboratory equipment or technical mathematical analyses. The FAA believes that these specifications would enhance compliance by taking greater advantage of readily obtainable FAA approved data and manufacturer's specifications.

In addition, this proposal provides more detailed specifications for microphones (and their accessories), tape recorders, analysis equipment, and calibrators. These revisions are primarily based upon experience with actual certifications and reports of some difficulty in understanding the current, more general language. While the proposals do not substantially change the application of procedures, the proposals would prescribe improved procedures and practices which should result in more uniform data. One of the new features of this proposal is the introduction of a new paragraph on calibration (proposed § A36.3(e)). This paragraph would require standardization of both calibration procedures and implementation schedules to provide more uniform and repeatable data by minimizing unaccounted for equipment variability and operator error.

3. *Reporting and correcting measured data (proposed § A36.5).*—Under the proposed rule, data representing physical measurements, or corrections to measured data (including corrections to measurements for equipment response deviations) must be recorded in permanent form and appended to the record. All corrections would be reported and subject to approval. The proposal permits certain estimates of the individual errors inherent in each of the operations employed in obtaining the final data.

The proposal clarifies the established procedure by expressly providing for a correction of any difference between the test engine rating and the reference engine rating. Additional standards are also provided for determining the validity of test results when more than one test site is used to demonstrate compliance.

4. *Symbols and unit (proposed § A36.7).*—Under the proposal, current section A36.4 would be redesignated but would remain substantively unchanged in content.

5. *Atmospheric attenuation of sound (proposed § A36.9).*—Under the current provisions of Appendix A (§ A36.5), the measured one-third octave band spectra are corrected to the reference-day conditions. Under the proposal (proposed § A36.9), this correction would be amended to better account for the differences in the atmospheric attenuation of sound between the test-day conditions and the reference-day conditions along the entire sound propagation path between the aircraft and the microphone.

FAA experience has shown that the measurement of, and correction for, non-reference meteorological conditions are exceedingly critical to obtaining consistent and repeatable test results. The FAA believes that more detailed meteorological data are needed and should be required. Specifically, current (test-time) meteorological observations of the temperature and relative humidity are needed over the whole sound propagation path from the aircraft to the surface. To avoid localized anomalous conditions that often occur near the ground, the surface meteorological measurements would continue to be made 10 meters above the surface.

Under the proposed § A36.9, if the atmospheric absorption coefficients vary over the sound propagation path by more than ±0.3 dB/1,000 feet in the 3150 Hz one-third octave band from the attenuation rate defined by the surface meteorological measurements, applicants would be required to base atmospheric attenuation corrections upon the mean attenuation rate for each one-third octave over the entire length of the sound propagation path. However, the absence of inversions in both temperature and relative humidity during compliance testing would no longer be a limiting factor in the test sequence.

The FAA believes the proposed amendments would provide technologically adequate means for correcting noise data that are obtained under some atmospheric conditions under which testing is prohibited under the current Appendix A. Taken together, the revisions of §§ A36.1 and A36.9 would provide improved data repeatability and increase the number of days during which tests may be conducted.

6. *Detailed correction procedures (Proposed § 36.11).*—If the noise certification test conditions do not conform to the noise certification reference conditions, appropriate positive correction must be made by the EPNL calculated from the measured data. Under the proposed § A36.11, the provisions of current § A36.6 would not be a significantly modified; however, the proposed rule would prescribe a procedure which allows corrections to be made for testing at a non-standard location.

For some aircraft which exhibit exceptionally low noise levels during takeoff, the FAA believes that it may be necessary to bring the 3.5 nautical-mile measuring station to a point closer to the start of roll to assure recording the complete flyover noise history. The fly-over-noise/time history would include the 10 dB-down points from PNLTM both before and after the time of PNLTM, as required under current § B36.5 (proposed § B36.13). The EPNL value computed from these measurements must then be corrected to the value that would have occurred at the 3.5 nautical mile reference measuring point. Two procedures for making these corrections would be prescribed under the proposed amendment.

B. PROPOSED AMENDMENT OF APPENDIX B

1. *Table B1 (in proposed § B36.3).*—Perceived noisiness is expressed units of "noys" and is based upon the mathematical formulation given in § B36.13. Table B1 was included in current Appendix B to provide a ready reference for these applicants who elect not to calculate noy values from the formula. While the original table contains values down to 1.00 noy, lower values are sometimes required in the calculation of EPNL for low noise aircraft. Thus, the FAA believes Table B1 should be revised to provide those lower values. Such a revised table was prepared by the Society of Automotive Engineers and published in ARP 865. The International Standards Organization concurred with the revision (ISO/IC 43/SC1, revised March 3, 1975). ICAO currently has under consideration a similar revision. The FAA believes that Table B2 should also be amended to conform to the expanded Table B1.

2. *Revision of pseudotone elimination procedures (Tables B2 and B3 in proposed §§ B36.3 and B36.5).*—The FAA proposes to amend Table B2 to account for tone level differences less than 3.0 decibels in amplitude, since the current table provides no tone correction for these level difference values. Table B2 was originally constructed to avoid the possibility that false tones, "pseudotones," would be mistakenly identified during the data processing. These pseudotones result from interference patterns in the sound field near the earth's surface during an aircraft flyover. However, FAA noise certification experience with the pseudotone problem indicates that such precautions are no longer necessary. Since similar action has been

taken by ICAO, the FAA proposes to remove the 3.0 decibel lower limit on the level difference used to determine the tone correction. If the proposed amendmend to Table B2 is adopted, the example contained in Table B3 would also require minor changes. Thus, this proposal also contemplates such amendments to Table B3.

A revised and expanded discussion on the methods for identifying and eliminating pseudotones is provided in proposed § B36.5 (m) and (n). The FAA believes these provisions are needed to clarify the prescribed methodology in the noise certification procedure.

3. *Correction for spectral irregularities (Proposed § B36.5).*—The FAA proposes to add two new paragraphs after the current last undesignated paragraph of current § B36.3 (proposed § B36.5). The first new paragraph would prescribe the exclusion of certain tones (resulting from ground-plane reflection) from calculations of corrections for spectral irregularities. The second paragraph would prescribe the evaluation of the five one-half second noise level samples around the initially calculated PNLTM. The FAA believes that occasionally the current ten-step procedure for calculating corrections for spectral irregularities yields incorrect values. The procedure, contained in current § B36.3, tends to undercompensate for tones occurring in frequencies near the crossover point between adjacent one-third octave filters. The FAA, ICAO, SAE and others have considered several proposed methods for overcoming this deficiency. After consideration of the side effects of the other methods, the FAA believes that the procedure proposed in this paragraph is the most appropriate and consistent.

C. Effective Date

The FAA proposes to make the proposals contained in this NPRM, applicable to each noise certification test conducted after March 31, 1977, or 30 days after publication of the final amendment, whichever occurs later.

In considering the date to propose for compliance with the amended specifications and procedures, the FAA believes it necessary to take into account that, if adopted, these new provisions could, in some cases, require additional instrumentation or revisions to existing data processing and analysis computer programs. Although the proposed revisions generally follow already established practices, the FAA is aware that some potential applicants may have had little or no recent noise certification experience. For these persons, the proposed changes may impose some burden. To ensure a reasonable period for these changes to be made, the FAA proposes that compliance with the revised Appendices A and B be required for tests conducted after March 31, 1977, or 30 days after publication of the final amendment, whichever occurs later.

D. Incorporations by Reference

While published materials which are incorporated by reference in Part 36 under 5 U.S.C. 552(a) and 1 CFR Part 51 are currently prescribed in the substantive provisions of the respective appendices, the FAA proposes to add a new § 36.9 to Subpart A which would contain the required statements of identification and availability of these materials. By so doing, the FAA believes that the readability of the effected rules would be improved and the need for repetitive material would be kept to a minimum. The new § 36.9 would also serve as a technical bibliography and reference source for information regarding the incorporated materials. Under the proposal, the incorporating provision would contain only a reference identifying the material which is adopted as part of that rule. The FAA proposes to adopt the material incorporated by reference according to the date of the material specified in the reference and proposed § 36.9(c). Notice and public procedure will precede the adoption of any subsequent editions of incorporated materials.

E. Evaluation of Impacts of the Proposed Rule

The proposed rule primarily concerns test procedure amendments which would govern the specifics of conducting and reporting noise certification tests. It would neither raise nor lower the prescribed noise levels and would not require additional tests to be performed during the certification process. As a result, there would be little or no change in the noise levels of aircraft certificated to the proposed rule and there would be no anticipated change (either increasing or decreasing) in the amount of fuel used to conduct the tests or the amount of engine emissions produced during the tests. Since the proposed rule would require no additional limitations on their in-service operations or performance, no increase in fuel usage or emissions is anticipated to result from aircraft certificated to the proposed standard.

The proposed rule would be more stringent than the current rule in the requiremept for noise certification test equipment, in the specification of the weather conditions, and in correction of test data to standard conditions. The increased stringency could, in some cases, increase the applicant's costs of noise type certification. However, the FAA believes that those costs could be offset by savings that would accrue from increased repeatability of the data. Current industry practice is to design and build aircraft using a tolerance below the actual noise level goals. The requirement for this tolerance arises from uncertainties in the repeatability of the data from tests under the current Part 36 procedures. Therefore, the FAA believes that by increasing the repeatability of the data, the proposed rule would contribute to reduced costs by eliminating unnecessary design features or performance limitations which would be introduced solely to meet the tolerance requirements.

The rule proposed in this notice has been reviewed in accordance with Executive Order 11821, entitled "Inflationary Impact Statements" (39 FR 41501; November 29, 1974) and it has been determined that the preparation of an inflationary impact statement is not necessary.

F. Authority

This notice of proposed rule making is issued under authority of Secs. 313(a), 601, 603, and 611 of the Federal Aviation Act of 1958, as amended (49 U.S.C. 1354 (a), 1421, 1423, and 1431); sec. 6(c) of the Department of Transportation Act (49 U.S.C. 1655(c)); Title I of the National Environmental Policy Act of 1969 (42 U.S.C. 4321 et seq.), and Executive Order 11514, March 5, 1970.

In consideration of the foregoing, the Federal Aviation Administration proposes to amend Part 36 of the Federal Aviation Regulations (14 CFR Part 36) as follows:

Subpart A—General

1. Subpart A of Part 36 would be amended to add a new § 36.9 reading as follows:

§ 36.9 Incorporations by reference.

(a) *General.* This part prescribes certain standards and procedures which are not set forth in full text in the rule. Those standards and procedures are contained in published material which is reasonably available to the class of persons affected and has been approved for incorporation by reference by the Director of the Federal Register under 5 U.S.C. § 552 (a) and 1 CFR Part 51.

(b) *Incorporated matter.* (1) Each publication, or part of a publication, which is referenced but not set forth in full-text in this part and which is identified in paragraph (c) of this section is hereby incorporated by reference and made a part of Part 36 of this chapter with the approval of the Director of the Federal Register.

(2) Incorporated matter which is subject to subsequent change is incorporated by reference according to the specific reference and to the identification statement. Adoption of each subsequent change in incorporated matter will be made under Part 11 of this chapter and 1 CFR Part 51.

(c) *Identification statement.* The complete title or description which identifies each published matter incorporated by reference in this part is as follows:

(1) *International Electrotechnical Commission (IEC) Publications.* (i) Publication No. 179, entitled "Precision Sound Level Meters," dated 1973.

(ii) Publication No. 225, entitled "Octave, Half-Octave, Third Octave Band Filters Intended for the Analysis of Sounds and Vibations," dated 1966.

(2) *Society of Automotive Engineers (SAE) Publications.* (i) (SAE) ARP 866A, entitled "Standard Values of Atmospheric Absorption as a Function of Temperature and Humidity for Use in Evaluating Aircraft Flyover Noise," dated March 15, 1975.

(ii) [Reserved]

(d) *Availability for purchase.* Published material incorporated by refer-

ence in this part may be purchased at the price established by the publisher or distributor at the following mailing addresses:

(1) *IEC publications.* (i) The Bureau Central de la Commission Electrotechnique Internationale, 1, rue de Varembe, Geneva, Switzerland.

(ii) American National Standard Institute, 1430 Broadway, New York City, New York 10018.

(2) *SAE publications.* Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrentown, Pennsylvania 15096.

(c) *Availability for inspection.* A copy of each publication incorporated by reference in this part is available for public inspection at the following locations:

(1) FAA Office of Environmental Quality, Room 939B Headquarters, Federal Aviation Administration, 800 Independence Avenue, SW., Washington, D.C.

(2) Department of Transportation, Branch Library, Room 930, Headquarters, Federal Aviation Administration, 800 Independence Avenue, SW., Washington, D.C.

(3) The respective Regional Offices of the Federal Aviation Administration as follows:

(i) New England Regional Office, 12 New England Executive Park, Burlington, Massachusetts.

(ii) Eastern Regional Office, Federal Building, JFK International Airport, Jamaica, New York.

(iii) Southern Regional Office, 3400 Whipple Street, East Point, Georgia.

(iv) Great Lakes Regional Office, 2300 East Devon, Des Plaines, Illinois.

(v) Central Regional Office, 601 East Twelfth Street, Kansas City, Missouri.

(vi) Southwest Regional Office, 4400 Blue Mound Road, Forth Worth, Texas.

(vii) Rocky Mountain Regional Office, 10255 East 25th Avenue, Aurora, Colorado.

(viii) Northwest Regional Office, FAA Building, 9010 East Marginal Way South, King County International Airport (Boeing Field), Seattle, Washington.

(ix) Western Regional Office, 15000 Aviation Boulevard, Hawthorne, California.

(x) Alaskan Regional Office, 632 Sixth Avenue, Anchorage, Alaska.

(xi) Pacific-Asia Regional Office, 1833 Kolakoua Avenue, Honolulu, Hawaii.

(xii) European Regional Office, Tour Madou Building, 1, Place Madou, 1020 Brussels, Belgium.

(4) The Office of the Federal Register, Room 8401, 1100 "L" Street, NW., Washington, D.C.

APPENDIX A

2. The heading to Appendix A would be amended to add a table of sections and Appendix A would be revised to read as follows:

APPENDIX A—AIRCRAFT NOISE MEASUREMENT UNDER § 36.101

Sec.

A36.1 *Noise certification test and measurement conditions.*
A36.3 *Measurement of aircraft noise received on the ground.*
A36.5 *Reporting and correcting measured data.*
A36.7 *Symbols and units.*
A36.9 *Atmospheric attenuation of sound.*
A36.11 *Detailed correction procedures.*

§ A36.1 *Noise certification test and measurement conditions.*

(a) *General.* This section prescribes the conditions under which aircraft noise certification tests must be conducted and the measurement procedures that must be used to measure aircraft noise during each test conducted after March 31, 1977 (or the date 30 days after publication of the final amendment, whichever occurs later).

(b) *Test site requirements.* (1) Tests to show compliance with established aircraft noise certification levels must consist of a series of takeoffs and approaches during which measurements must be taken at noise measuring stations located at the measuring points prescribed in § C36.3 of Appendix C of this part.

(2) On each test takeoff, simultaneous measurements should be made at the sideline noise measuring stations on each side of the runaway and also at the takeoff noise measuring station. However, if test site conditions make it impractical to simultaneously measure takeoff and sideline noise, and if each of the other sideline measurement requirements is met, independent measurements may be made of the sideline noise under simulated flight path techniques. If the reference flight path includes a power cutback before the maximum possible sideline noise level is developed, the reduced sideline noise level which is the maximum value developed by the simulated flight path technique must be the certificated sideline noise value.

(3) If the height of the ground at a noise measuring station differs from that of the nearest point on the runway by more than 20 feet, corrections must be made as prescribed in § A36.5(d) of this appendix.

(4) The location of each noise measuring station must be surrounded by relatively flat terrain having no excessive sound absorption characteristics, such as might be caused by thick, matted, or tall grass, shrubs, or wooded areas.

(5) An airport tower, or other facility, used to obtain required measurements of meteorological conditions at the test site must be approved in accordance with § A36.9(b)(1) of this appendix.

(6) During the period when the flyover noise/time record indicates the noise measurement is within 10 dB of PNLTM, no obstruction that significantly influences the sound field from the aircraft may exist:

(i) For a takeoff, approach, or sideline measurement station, within a conical space above the measuring position (the point on the ground vertically below the microphone), the cone being defined by an axis normal to the ground and by a half-angle 80 degrees from this axis; and

(ii) For a sideline noise measurement station, above the line of sight between the microphone and the aircraft.

(7) A minimum of four sideline noise measurement stations must be used to define the maximum sideline noise with respect to location and level as required by § C36.3 of Appendix C of this part. One of the microphones must be placed symmetrically with respect to one of the other microphones so that the maximum noise on either side of the aircraft can be determined analytically.

(c) *Weather restrictions.* The tests must be conducted under the following atmospheric conditions:

(1) No rain or other precipitation.

(2) Ambient air temperature between 36 degrees F and 95 degrees F (2.2 degrees C and 35 degrees C), inclusively, over that portion of the sound propagation path between the airplane and a point 10 meters above the ground at the noise measuring station.

(3) Relative humidity and ambient temperature over that portion of the sound propagation path between the airplane and a point 10 meters above the ground at the noise measuring station is such that the sound attenuation in the one-third octave band centered at 8 kHz is not greater than 10 dB/100 meters [alternative proposal: "12 dB/100 meters"] and the relative humidity is between 20 percent and 95 percent, inclusively.

(4) Airport reported wind velocity 10 meters above ground does not exceed 10 knots and the crosswind component does not exceed 5 knots.

(5) No anomalous wind conditions (including turbulence) which will significantly affect the noise level of the aircraft when the noise is recorded at each noise measuring station.

(d) *Aircraft testing procedures.*—(1) The aircraft testing procedures and noise measurements must be conducted and processed in an approved manner which yields the noise evaluation measure designated as Effective Perceived Noise Level (EPNL) in units of EPNdB, as prescribed in Appendix B of this part.

(2) The aircraft height and lateral position relative to the extended centerline of the runway must be determined by an FAA approved method which is independent of normal flight instrumentation, such as radar tracking, theodolite triangulation, laser trajectography, or photographic scaling techniques.

(3) The aircraft position along the flight path must be related to the noise recorded at the noise measuring stations by means of synchronizing signals at an approved sampling rate. The position of the aircraft must be automatically recorded relative to the runway during the entire time period in which the recorded signal is within 10 dB of PNLTM. Measuring and sampling equipment must be approved by the FAA.

(4) Each takeoff test must meet the conditions of § C36.7 of Appendix C of this part.

(5) If a takeoff test series is conducted at weights other than the maximum takeoff weight for which noise certification is requested, the following additional requirements apply:

(i) At least one takeoff test must be conducted at a weight at, or above, the maximum certification weight.

(ii) Each test weight must be within ±5 percent of the maximum certification weight.

(iii) The weight correction required under § A36.11 of this appendix may not exceed 2.0 EPNdB. (Approved data must be used to determine the variation of EPNL with weight for takeoff test conditions.)

(6) Each approach test must be conducted with the aircraft stabilized and following a 3.0 degree ±0.5 degree approach angle and must meet the requirements of § C36.9 of Appendix C of this part.

(7) If approach test series is conducted at weights other than the maximum landing weight for which certification is requested, the following additional requirements apply:

(i) At least one approach test must be conducted at a weight at, or above, the maximum landing weight.

(ii) Each test weight must exceed 90 percent of the maximum landing weight.

(iii) The weight correction required under § 36.11 of this appendix may not exceed 1.0 EPNdB. (Approved data must be used to determine the variation of EPNL with weight for approach test conditions).

(8) Aircraft performance data sufficient to make the correction required under § A36.5 of this appendix must be automatically recorded at an approved sampling rate using FAA approved equipment.

§ A36.3 *Measurement of aircraft noise received on the ground.* (a) *General.*—(1) The measurements prescribed in this section provide the data for determining the one-third octave band noise produced by aircraft during testing procedures, at specific noise measuring stations, as a function of time.

(2) Sound pressure level data for aircraft noise certification purposes must be obtained with approved acoustical equipment and measurement practices.

(3) Paragraphs (b), (c), and (d) of this section prescribe the required equipment specifications. Paragraphs (e) and (f) pre-

scribe the calibration and measurement procedures required for each certification test series.

(b) *Measurement system.*—The acoustical measurement system must consist of approved equipment equivalent to the following:

(1) A microphone system with frequency response and directivity which are compatible with the measurement and analysis system accuracy prescribed in paragraph (c) of this section.

(2) Tripods or similar microphone mountings that minimize interference with the sound energy being measured.

(3) Recording and reproducing equipment whose characteristics, frequency response, and dynamic range are compatible with the response and accuracy requirements of paragraph (c) of this section.

(4) Calibrators using sine wave, or pink noise, of known levels. When pink noise (defined in paragraph (e)(1) of this section) is used, the signal must be described in terms of its root-mean-square (rms) value.

(5) Analysis equipment with the response and accuracy whichs meets or exceeds the requirements of paragraph (d) of this section.

(6) Attenuators used for range changing in sensing, recording, reproducing, or analyzing aircraft sound must be capable of being operated in equal integral decibel steps with no error between any two settings which exceeds 0.1 dB.

(c) *Sensing, recording, and reproducing equipment.* (1) The sound produced by the aircraft must be recorded in such a way that the complete information, including time history, is retained. A magnetic tape recorder is acceptable.

(2) The microphone must be a pressure-sensitive capacitive type, or its approved equivalent, such as a free-field type with incidence corrector.

(i) The variation of microphone and preamplifier system sensitivity within an angle of ± 20 degree of grazing (70–110) degrees from the normal to the diaphragm) must not exceed ± 2.0 dB for any frequency within the range of 44 Hz to 11,200 Hz. The variation of microphone sensitivity in the plane of the diaphragm must not exceed ± 0.5 dB over the same frequency range.

(ii) The overall free-field frequency response at 90 degrees (grazing incidence) of the combined microphone (including incidence corrector, if applicable) preamplifier, windscreen, and microphone support must be determined by using pure tones at each preferred one-third octave frequency from 50 Hz to 10,000 Hz. The frequency response of the system must be flat within the following tolerances:

44–3549 Hz	dB ±	0.25
3550–7099 Hz	dB ±	0.5
7100–11,200 Hz	dB ±	1.0

(iii) Specifications concerning sensitivity to environmental factors such as temperature, relative humidity, and vibration must be in conformity with the recommendations of International Electrotechnical Commission (IEC) Publication No. 179, dated 1973. IEC Publication No. 179, dated 1973 and entitled "Precision Sound Level Meters" is incorporated by reference in this part under § 36.9 of this part.

(iv) If the wind speed exceed 6 knots, a windscreen must be employed with the microphone during each measurement of aircraft noise. Correction for any insertion loss produced by the windscreen, as a function of frequency, must be applied to the measured data and any correction applied must be reported.

(3) If a magnetic tape recorder is used to store data for subsequent analysis, the record/replay system (including tape) must conform to the following:

(i) The electric background noise produced by the system in each one-third octave must be at least 35 dB below the standard recording level, which is defined as that level which is either 10 dB below the 3 percent harmonic distortion level for direct recording or ± 40 percent deviation for frequency modulation (FM) recording.

(ii) At the standard recording level, the frequency response in each selected one-third octave band between 44 Hz and 180 Hz must be flat within ±0.75 dB, and in each band between 180 Hz and 11,200 Hz must be flat within ±0.25 dB.

(iii) If the overall system satisfies the requirements of paragraph (c)(2)(ii) of this section, and if the limitations of the dynamic range of the equipment make it necessary, high frequency pre-emphasis may be added to the recording channel with the converse de-emphasis on playback. If pre-emphasis is added, the instantaneously recorded sound-pressure level between 800 Hz and 11,200 Hz of the maximum measured noise signal must not vary more than 20 dB between the levels of the maximum and minimum one-third octave bands.

(d) *Analysis equipment.*—(1) A frequency analysis of the acoustic signal must be performed using one-third octave filters which conform to the recommendations of International Electrotechnical Commission (IEC) Publication No. 225, dated 1966, IEC Publication No. 225, dated 1966, and entitled "Octave, Half-Octave, and Third-Octave Band Filters Intended for Analysis of Sounds and Vibrations" is incorporated by reference in this part under § 36.9 of this part.

(2) A set of 24 consecutive one-third octave filters must be used. The first filter of the set must be centered at a geometric mean frequency of 50 Hz and the last filter at 10,000 Hz. The output of each filter must contain less than 0.5 dB ripple.

(3) The analyzer indicating device must be analog, digital, or a combination of both. The preferred sequence of signal processing is:

(i) Squaring the one-third octave filter outputs;

(ii) Averaging or integrating; and

(iii) Converting linear formulation to logarithmic.

(4) Each detector must operate over a minimum dynamic range of 60 dB and perform as a true-mean-square device for sinusoidal tone bursts having crest factors of at least 3 over the following dynamic range:

(i) Up to 30 dB below full-scale reading must be accurate within ±0.5 dB;

(ii) Between 30 dB and 40dB below full-scale reading must be accurate within ±1.0 dB; and

(iii) In excess of 40dB below full-scale reading must be accurate within ±2.5 dB.

(5) The dynamic response of the analyzer to input signals in both full-scale, and 20 dB less than full-scale, amplitude must conform to the following requirements:

(i) When a sinusoidal pulse of 500 millisecond duration at the geometrical mean frequency of each one-third octave band is applied to the input, the maximum output value must read 4.0 dB (within +0.5 or −1.0 dB) less than the value obtained for a steady state sinusoidal signal of the same frequency and amplitude.

(ii) When a steady state sinusoidal signal at the geometrical mean frequency of each one-third octave band is suddenly applied to the analyzer input and held constant, the maximum output value must exceed the final steady state value by 0.5±0.5 dB.

(iii) When a steady state signal is interrupted, an output value of 2.5±1.0 dB below the initial steady-state response must be achieved within 500 milliseconds after the interruption.

(6) A single value of the root-mean-square (rms) level must be provided every 500±5 milliseconds for each of the 24 one-third octave bands. The levels for all of the 24 one-third octave bands must be obtained within a 50 millisecond period. No more than 5 milliseconds of data from any 500 millisecond period may be excluded from the measurement.

(7) The amplitude resolution of the analyzer must be at least 0.25 dB.

(8) After all systematic errors have been eliminated, each output level from the analyzer must be accurate within ±1.0 dB of the level of the input signal. The total systematic errors for each of the output levels must not exceed ±3.0 dB. For contiguous filter systems, the systematic correction between adjacent one-third octave channels must not exceed 4.0 dB.

(9) The dynamic range capability of the analyzer for display of a single aircraft noise event (in terms of the difference between full-scale output level and the maximum noise level of the analyzer equipment) must be at least 60 dB.

(e) *Calibrations.*—(1) Within the five days before the beginning of each test series, the complete electronic system (including cables) must be electronically calibrated for frequency and amplitude by the use of a pink noise signal of known amplitudes covering the range of signal levels furnished by the microphone. For purposes of this section, a "pink noise" is defined as a noise whose noise-power/unit-frequency is inversely proportional to frequency at frequencies within the range of 44 Hz to 11,200 Hz. The signal used must be described in terms of its average root-mean-square (rms) values for a nonoverload signal level. This system calibration must be repeated within five days of the end of each test series.

(2) Immediately before and after each day's testing, a recorded acoustic calibration of the system must be made in the field with an acoustic calibrator to check the system sensitivity and provide an acoustic reference level for the analysis of the sound level data. The performance of equipment in the system will be considered satisfactory if, during each day's testing, the variation does not exceed 0.5 dB.

(3) For the purpose of minimizing equipment or operator error, immediately before and immediately after recording aircraft noise data, field calibrations must be supplemented with the use of an insert voltage device to place a known signal at the input of the microphone.

(4) A normal incidence pressure calibration of the combined microphone/preamplifier must be performed with pure tones at each preferred one-third octave frequency from 50 Hz to 10,000 Hz. This calibration must be completed within the 30 days before the beginning of each test series.

(5) Each reel of magnetic tape must:

(i) Be pistonphone calibrated; and

(ii) At its beginning and end, carry a calibration signal consisting of a 30 second burst of pink noise, as defined in paragraph (e)(1) of this section.

(6) Data obtained from tape recorded signals is not considered reliable if the difference between the pink noise signal levels, before and after the tests in each one-third octave band, exceeds 0.5 dB.

(7) The one-third octave filters must have been demonstrated to be in conformity with the recommendations of IEC Publication 225, dated 1966, during the six calendar months

preceding the beginning of each test series. The correction for effective bandwidth relative to the center frequency response must be determined for each filter—

(i) By measuring the filter response to sinusoidal signals at a minimum of twenty frequencies equally spaced between the two adjacent preferred one-third octave frequencies; or

(ii) By using an approved sweep generator technique.

(8) A performance calibration analysis of each piece of calibration equipment, including pistonphones, reference microphones, and voltage insert devices, must have been made during the 12 calendar months preceding the beginning of each day's test series. Each calibration must be traceable to the National Bureau of Standards.

(f) *Noise measurement procedures.* (1) Each microphone must be oriented so that the diaphragm is substantially in the plane defined by the flight path of the aircraft and the measuring station. The microphone located at each noise measuring station must be placed so that its sensing element is approximately 4 feet above ground.

(2) Immediately before and immediately after each series of test runs and each day's testing, a recorded acoustic calibration of the system prescribed in A36.3(e)(2) of this appendix must be made in the field to check the acoustic reference level for the analysis of the sound level data. The ambient noise, including both the acoustical background and the electrical background of the measurement systems, must be recorded during the period beginning at least 20 seconds before and ending at least 20 seconds after each recorded measurement. During that period, each component of the system must be set at the gain-levels used for aircraft noise measurement.

(3) The mean background noise spectrum must contain the sound pressure levels, which, in each preferred third octave band in the range of 50 Hz to 10,000 Hz, are the averages of the energy during at least 20 seconds of the sound pressure levels in every preferred third octave. When analyzed in PNL, the resulting mean background noise level must be at least 20 PNdB below the maximum PNL of the aircraft.

(4) Corrections for recorded levels of occasional background noise are allowed, within the limits prescribed in § A36.5(d)(3) of this appendix.

A36.5. *Reporting and correcting measured data.*

(a) *General.* Data representing physical measurements, or corrections to measured data, including corrections to measurements for equipment response deviations, must be recorded in permanent form and appended to the record. Each correction must be reported and is subject to FAA approval. An estimate must be made of each individual error inherent in each of the operations employed in obtaining the final data.

(b) *Data reporting.* (1) Measured and corrected sound pressure levels must be presented in one-third octave band levels obtained with equipment conforming to the standards prescribed in § A36.3 of this appendix.

(2) The type of equipment used for measurement and analysis of all acoustic, aircraft performance, and meteorological data must be reported.

(3) The atmospheric environmental data required to demonstrate compliance with § A36.1(c) of this appendix, measured throughout the test period under § A36.9(b)(3) of this appendix, must be reported.

(4) Conditions of local topography, ground cover, or events which may interfere with sound recording must be reported.

(5) The following aircraft information must be reported:

(i) Type, model, and serial numbers (if any) of aircraft engines.

(ii) Gross dimensions of aircraft and location of engines.

(iii) Aircraft gross weight for each test run.

(iv) Aircraft configuration, including flap and landing gear positions.

(v) Airspeed in knots.

(vi) Engine performance in pounds of net thrust, engine pressure ratios, exhaust temperatures, and fan or compressor shaft rotational speeds, as determined from airplane instruments and manufacturer's data.

(vii) Aircraft flight path (above ground level in feet) determined by an FAA approved method which is independent of normal flight instrumentation, such as radar tracking, theodolite triangulation, laser trajectography, or photographic scaling techniques.

(6) Aircraft speed and position, and engine performance parameters must be recorded at an approved sampling rate sufficient to correct to the noise certification reference conditions prescribed in pararaph (c) of this section. Lateral position relative to the extended centerline of the runway, configuration, and gross weight must be reported.

(c) *Noise certification reference conditions*—(1) *Meteorological conditions.* Aircraft position and performance data and the noise measurements must be corrected to the following noise certification reference atmospheric conditions:

(i) Sea level pressure of 2116 psf (76 cm mercury).

(ii) Ambient temperature of 77 degrees F (25 degrees C).

(iii) Relative humidity of 70 percent.

(iv) Zero wind.

(2) *Aircraft conditions.* The reference condition for takeoff is the maximum weight except as provided in § 36.1581(b) of this part. The reference conditions for approach tests consist of—

(i) Design landing weight, except as provided in § 36.1581(b) of this part;

(ii) Approach angle of 3 degrees; and

(iii) Aircraft height of 370 feet above noise measuring station.

(d) *Data corrections.* (1) Aircraft position and performance data and the noise measurement must be corrected to the noise certification reference conditions as prescribed in paragraph (c) of this section. The measured atmospheric conditions must be those obtained in accordance with § A36.1(c) of this appendix and paragraph (b)(3) of sound corrections must be made under § A36.9 of this appendix.

(2) The measured flight path must be corrected by an amount equal to the difference between the applicants predicted flight path for the certification reference conditions and the measured flight path at the test conditions. Necessary corrections relating to aircraft flight path or performance may be derived from approved data other than certification test data. The source noise must be corrected from approved data for the difference between measured and corrected engine conditions, together with appropriate allowances for sound attenuation with distance. The Effective Perceived Noise Level (EPNL) correction must be less than 2.0 EPNdB for any combination of the following:

(i) The aircraft's not passing vertically above the measuring station.

(ii) Any difference between 370 feet and the actual minimum distance of the aircraft's ILS antenna from the approach measuring station.

(iii) Any difference between the actual approach angle and the noise certification reference approach flight path.

(iv) Any correction of the measured noise levels which accounts for any difference between the test engine rating and the reference engine rating.

Detailed correction requirements are prescribed in § A36.11 of this appendix.

(3) If aircraft sound pressure levels do not exceed the mean background sound pressure levels determined under § A36.3(f)(3) by at least 5 dB in each one-third octave band within the 10 dB-down points described in § B36.9 of Appendix B of this part, that frequency band may not be included in the computation of the overall noise level of the aircraft. An EPNL may not be computed or reported from data from which more than four one-third octave bands in any spectrum within the 10 dB-down points have been excluded under this paragraph.

(e) *Validity of results.* (1) The test results must produce three average EPNL values within the 90 percent confidence limits, each value consisting of the arithmetic average of the corrected noise measurements for all valid test runs at the takeoff, approach, and sideline measuring stations, respectively. If more than one noise measurement system is used at any single measuring station, the resulting data for each test run (after correction) must be averaged as a single measurement. If more than one test site or noise measuring station location is used, each valid test run must be included in the computation of the average EPNL values and their confidence limits.

(2) The minimum sample size acceptable for each of the three certification measurements (takeoff, approaches, and sideline) is six. The number of samples must be large enough to establish statistically for each of the three average noise certification levels a 90 percent confidence limit which does not exceed ±1.0 EPNdB. No test result may be omitted from the averaging process, unless otherwise specified by the FAA.

(3) The average EPNL values and their 90 percent confidence limits obtained by the procedure described in this paragraph must be those by which the noise emission of the aircraft is assessed against the noise certification criteria, and must be reported.

§ A36.7 *Symbols and units.*

(a) *General.* The symbols used in Appendixes A and B of this Part have the following meanings.

Symbol	Unit	Meaning
ant	—	*Antilogarithm to the Base 10*
C(k)	dB	*Tone Correction.* The factor to be added to PNL(k) to account for the presence of spectral irregularities such as tones at the k-th increment of time.
d	sec	*Duration Time.* The length of the significant noise time history being the time interval between the limits of t(1) and t(2) to the nearest second.
D	dB	*Duration Correction.* The factor to be added to PNLM to account for the duration of the noise.
EPNL	EPNdB	*Effective Perceived Noise Level.* The value of PNL adjusted for both the presence or discrete frequencies and the time history. (The unit EPNdB is used instead of the unit dB.)
f(i) or fi	Hz	*Frequency.* The geometrical mean frequency for the i-th one-third octave band.
F(i,k)	dB	*Delta-dB.* The difference between the original and background sound pressure levels in the i-th one-third octave band at the k-th interval of time.

Symbol	Unit	Meaning
h	dB	*dB-Down.* The level to be subtracted from PNLTM that defines the duration of the noise.
H	%	*Relative Humidity.* The ambient atmospheric relative humidity.
(i) or i	—	*Frequency Band Index.* The numerical indicator that denotes any one of the 24 one-third octave bands with geometrical mean frequencies from 50 to 10,000 Hz.
(k)	—	*Time Increment Index.* The numerical indicator that denotes the number of equal time increments that have elapsed from a reference zero.
log	—	*Logarithm to the Base 10.*
log n(a)	—	*Noy Discontinuity Coordinate.* The log n value of the intersection point of the straight lines representing the variation of SPL with log n.
M(b), M(c)	—	*Noy Inverse Slope.* The reciprocals of the slopes of the straight lines representing the variation of SPL with log n.
n	noy	*Perceived Noisiness.* The perceived noisiness at any instant of time that occurs in a specified frequency range.
n(i, k)	noy	*Perceived Noisiness.* The perceived noisiness at the k-th instant of time that occurs in the i-th one-third octave band.
n(k)	noy	*Maximum Perceived Noisiness.* The maximum value of all of the 24 values of n(i) that occurs at the k-th instant of time.
N(k)	noy	*Total Perceived Noisiness.* The total perceived noisiness at the k-th instant of time calculated from the 24-instantaneous values of n(i, k).
p(b), p(c)	—	*Noy Slope.* The slopes of the straight lines representing the variation of SPL with log n.
PNL	PNdB	*Perceived Noise Level.* The perceived noise level at any instant of time (the unit PNdB is used instead of the unit dB).
PNL(k)	PNdB	*Perceived Noise Level.* The perceived noise level calculated from the 24 values of SPL(i, k) at the k-th increment of time. (The unit PNdB is used instead of the unit dB.)
PNLM	PNdB	*Maximum Perceived Noise Level.* The maximum value of PNL(k) that occurs during the aircraft flyover. (The unit PNdB is used instead of the unit dB.)
PNLT	PNdB	*Tone Corrected Perceived Noise Level.* The value of PNL adjusted for the presence of spectral irregularities (discrete frequencies) at any instant of time. (The unit PNdB is used instead of the unit dB.)
PNLT(k)	PNdB	*Tone Corrected Perceived Noise Level.* The value of PNL(k) adjusted for the presence of discrete frequencies that occurs at the k-th increment of time. (The unit PNdB is used instead of the unit dB.)
PNLTM	PNdB	*Maximum Tone Corrected Perceived Noise Level.* The maximum value of PNLT(k) that occurs during the aircraft flyover. (The unit PNdB is used instead of the unit dB.)
s(i, k)	dB	*Slope of Sound Pressure Level.* The change in level between adjacent one-third octave band sound pressure levels at the i-th band for the k-th instant of time.
Δs(i, k)	dB	*Change in Slope of Sound Pressure Level.*
s′(i, k)	dB	*Adjusted Slope of Sound Pressure Level.* The change in level between adjacent adjusted one-third octave band sound pressure levels at the i-th band for the k-th instant of time.
s(i, k)	dB	*Average Slope of Sound Pressure Level.*
SPL	dB re 0.0002 microbar.	*Sound Pressure Level.* The sound pressure level at any instant of time that occurs in a specified frequency range.
SPL(a)	dB re 0.0002 microbar.	*Noy Discontinuity Coordinate.* The SPL value of the intersection point of the straight lines representing the variation of SPL with log n.
SPL(b)	dB re	*Noy Intercept.* The intercepts
SPL(c)	0.0002 microbar.	on the SPL-axis of the straight lines representing the variation of SPL with log n:
SPL(i, k)	dB re 0.0002 microbar.	*Sound Pressure Level.* The sound pressure level at the k-th instant of time that occurs in the i-th one-third octave band.
SPL′(i, k)	dB re 0.0002 microbar.	*Adjusted Sound Pressure Level.* The first approximation to background level in the i-th one-third octave band for the k-th instant of time.
SPL″(i, k)	dB re 0.0002 microbar.	*Background Sound Pressure Level.* The final approximation to background level in the i-th one-third octave band for the k-th instant of time.
SPLi	dB re 0.0002 microbar.	*Maximum Sound Pressure Level.* The sound pressure level that occurs in the i-th one-third octave band of the spectrum for PNL-TM.
SPLic	dB re 0.0002 microbar.	*Corrected Maximum Sound Pressure Level.* The sound pressure level that occurs in the i-th one-third octave band of the spectrum for PNLTM corrected for atmospheric sound absorption.
t	sec	*Elapsed Time.* The length of time measured from a reference zero.
t(1), t(2)	sec	*Time Limit.* The beginning and end of the significant noise time history defined by h.
Δt	sec	*Time Increment.* The equal increments of time for which PNL(k) and PNLT (k) are calculated.
T	sec	*Normalizing Time Constant.* The length of time used as a reference in the integration method for computing duration corrections.
T	°F	*Temperature.* The ambient atmospheric temperature.
αi	dB/ft	*Test Atmospheric Absorption.*
αi′	dB/1000 ft.	The atmospheric attenuation of sound that occurs in the i-th one-third octave band for the measured atmospheric temperature and relative humidity.
αio	dB/ft	*Reference Atmospheric Absorption.*
αio′	dB/1000 ft.	The atmospheric attenuation of sound that occurs in the i-th one-third octave band for the reference atmospheric temperature and relative humidity.
β	degrees	*First Constant Climb Angle.*
γ	degrees	*Second Constant Climb Angle.*
δ	degrees	*Thrust Cutback Angles.* The
ϵ	degrees	angles defining the points on the takeoff flight path at which thrust reduction is started and ended respectively.
η	degrees	*Approach Angle.*
θ	degrees	*Takeoff Noise Angle.* The angle between the flight path and noise path for takeoff operation. It is identical for both measured and corrected flight paths.
λ	degrees	*Approach Noise Angle.* The angle between the flight path and the noise path for approach operation. It is identical for both measured and corrected flight paths.
Δ1	EPNdB	*PNLT Correction.* The correction to be added to the EPNL calculated from measured data to account for noise level changes due to differences in atmospheric absorption and noise path length between reference and test conditions.
Δ2	EPNdB	*Noise Path Duration Correction.* The correction to be added to the EPNL calculated from measured data to account for noise level changes due to the noise duration because of differences in flyover altitude between reference and test condition.
Δ3	EPNdB	*Weight Correction.* The correction to be added to the EPNL calculated from measured data to account for noise level changes due to differences between maximum and test aircraft weights.
Δ4	EPNdB	*Approach Angle Correction.* The correction to be added to the EPNL calculated from measured data to account for noise level changes due to differences between 3° and the test approach angle.
ΔAB	feet	*Takeoff Profile Changes.* The
$\Delta\beta$	degrees	changes in the basic parameters, defining the takeoff
$\Delta\gamma$	degrees	profile due to differences
$\Delta\delta$	degrees	between reference and test
$\Delta\epsilon$	degrees	conditions.

FLIGHT PROFILE IDENTIFICATION POSITIONS

Position	Description
A	Start of takeoff roll.
B	Liftoff.
C	Start of first constant climb.
D	Start of thrust reduction.
E	Start of second constant climb.
Ec	Start of second constant climb on corrected flight path.
F	End of noise certification takeoff flight path.
Fc	End of second constant climb on corrected flight path.
G	Start of noise certification approach flight path.
Gr	Start of noise certification approach on reference flight path.
H	Position on approach path directly above noise measuring station.
I	Start of level off.
Ir	Start of level off on reference approach flight path.
J	Touchdown.
K	Takeoff noise measuring station.
L	Sideline noise measuring station (not on flight track).
M	End of noise type certification takeoff flight track.
N	Approach noise measuring station.
O	Threshold of approach end of runway.
P	Start of noise type certification approach flight track.
Q	Position on measured takeoff flight path corresponding to PNLTM at station K.
Qc	Position on corrected takeoff flight path corresponding to PNLTM at station K.
R	Position on measured takeoff flight path nearest to station K.
Rc	Position on corrected takeoff flight path nearest to station K.
S	Position on measured approach flight path corresponding to PNLTM at station N.
Sr	Position on reference approach flight path corresponding to PNLTM at station N.
T	Position on measured approach flight path nearest to station N.
Tr	Position on reference approach flight path nearest to station N.
X	Position on measured takeoff flight path corresponding to PNLTM at station L.

FLIGHT PROFILE DISTANCES

Distance	Unit	Meaning
AB	feet	*Length of Takeoff Roll.* The distance along the runway between the start of takeoff roll and lift off.
AK	feet	*Takeoff Measurement Distance.* The distance from the start of roll to the takeoff noise measurement station along the extended centerline of the runway.
AM	feet	*Takeoff Flight Track Distance.* The distance from the start of roll to the takeoff flight track position along the extended centerline of the runway for which the position of the aircraft need no longer be recorded.

Distance	Unit	Meaning
KQ	feet	*Measured Takeoff Noise Path.* The distance from station K to the measured aircraft position Q.
KQc	feet	*Corrected Takeoff Noise Path.* The distance from station K to the corrected aircraft position Qc.
KR	feet	*Measured Takeoff Minimum Distance.* The distance from station K to point R on the measured flight path.
KRc	feet	*Corrected Takeoff Minimum Distance.* The distance from station K to point Rc on the corrected flight path.
LX	feet	*Measured Sideline Noise Path.* The distance from station L to the measured aircraft position X.
NH	feet	*Aircraft Approach Height.* The vertical distance between the aircraft and the approach measuring station.
NS	feet	*Measured Approach Noise Path.* The distance from station N to the measured aircraft position S.
NSr	feet	*Reference Approach Noise Path.* The distance from station N to the reference aircraft position Sr.
NT	feet	*Measured Approach Minimum Distance.* The distance from station N to point T on the measured flight path.
NTr	feet	*Reference Approach Minimum Distance.* The distance from station N to point Tr on the corrected flight path; it equals 369 feet.
ON	feet	*Approach Measurement Distance.* The distance from the runway threshold to the approach measurement station along the extended centerline of the runway.
OP	feet	*Approach Flight Track Distance.* The distance from the runway threshold to the approach flight track position along the extended centerline of the runway for which the position of the aircraft need no longer be recorded.

§ A36.9 *Atmospheric attenuation of sound.*

(a) *General.* The measured values of the one-third octave band spectra must conform, or be corrected, to the reference-day conditions listed in § A36.5(c) of this appendix. Each correction must account for any differences in the atmospheric attenuation of sound between the test-day conditions and the reference-day conditions along the sound propagation path between the aircraft and the microphone. Unless the meteorological conditions conform to these prescribed in § A36.1(c) of this appendix, the test data are not acceptable.

(b) *Meteorological measurements.* (1) The location of an airport, or other facility, used for meteorological measurements must be approved for use as representative of those atmospheric conditions existing near the surface over the geographical area in which aircraft noise measurements are made. However, for the purpose of making corrections under this section, the wind velocity, temperature, and relative humidity must be measured in the vicinity of the microphones at the takeoff, approach, and sideline measuring stations.

(2) The temperature and relative humidity must be measured from a point 10 meters above the surface at the measuring stations to the altitude of the aircraft, using previously approved equipment and methods.

(3) Time intervals between meteorological measurements may not exceed 45 minutes during any test period. Meteorological data must be interpolated to actual times of each noise measurement.

(c) *Attenuation rates.* The atmospheric attenuation rates of sound with distance for each one-third octave band from 50 Hz to 10,000 Hz must be determined inaccordance with the formulations and tabulations of SAE ARP 866A, dated March 15, 1975. SAE ARP 866A, dated March 15, 1975, and entitled "Standard Values of Atmospheric Absorption as a Function of Temperatures and Humidity for Use in Evaluating Aircraft Flyover Noise" is incorporated by reference in to part under § 36.9 of this part.

(d) *Correction for atmospheric attentuation.* (1) EPNL values calculated for measured data must be corrected by the methods prescribed in § A36.11(d) of this appendix whenever—

(i) The ambient atmospheric conditions of temperature and relative humidity do not conform to the reference conditions (77 degrees F and 70 percent, respectively), or

(ii) The measured takeoff and approach flight paths do not conform to the corrected and reference flight paths.

(2) If the atmospheric absorption coefficients do not vary over the sound propogation path by more than ±0.3 dB/1000 feet in the 3150 Hz one-third octave band from the attenuation rate derived from the meteorological measurement under paragraph (b) of this section, the measurements prescribed in paragraph (b)(2) of this section may be used to determine the atmospheric attenuation rates for each one-third octave band.

The resulting atmospheric attenuation rate may be used to compute the PNLT correction under § A36.11(d) of this appendix.

(3) If the conditions do not conform to those prescribed in paragraph (d)(2) of this section, the corrections for atmospheric attenuation must be determined by the following layered-atmosphere procedure:

(i) The sound propagation path must be divided into increments no greater than 100 feet in altitude, and the average temperature and relative humidity that exists within each increment at the time of the test must be calculated from the meteorological data required by paragraph (b) of this section.

(ii) Atmospheric attenuation rates must be determined under paragraph (c) of this section for each one-third octave band in each altitude increment.

(iii) The mean attenuation rate over the complete sound propagation path from aircarft to microphone must be computed for each one-third octave band from 50 Hz to 10,000 Hz. These rates must be used in computing the corrections required in § A36.11(d) of this appendix.

§ A36.11 *Detailed correction procedures.*

(a) *General.* If the test conditions do not conform to those prescribed as noise certification reference conditions under § A36.5 of this appendix, the following correction procedure and requirements apply:

(1) If a positive value results from any difference between reference and test conditions, an appropriate positive correction must be made to the EPNL calculated from the measured data. Conditions which can result in a positive value include:

(i) Atmospheric absorption of sound under test conditions which is greater than the reference;

(ii) Test flight path at an altitude which is higher than the reference; or

(iii) Test weight which is less than maximum certification weight.

(2) If a negative value results from any difference between reference and test conditions, no correction may be made to the EPNL calculated from the measured data, unless the difference results from:

(i) An atmospheric absorption of sound under test conditions which is less than the reference; or

(ii) A test flight path at an altitude which is lower than the reference.

(3) The following correction procedures may produce one or more possible correction values which must be added algebraically to the EPNL calculated as if the tests were conducted completely under the noise certification reference conditions:

(i) The flight profiles must be determined for both takeoff and approach, and for both reference and test conditions. The procedures require noise and flight path recording with a syncronized time signal from which the test profile can be delineated, including the aircraft position for which PNLTM is observed at the noise measuring station. For takeoff, the flight profile corrected to reference conditions may be derived from manufacturer's data; however, for approach, the reference profile must be determined.

(ii) The sound propagation paths to the microphone from the aircraft position corresponding to PNLTM are determined for both the test and reference profiles. The SPL values in the spectrum of PNLTM must then be corrected for the effects of:

(A) Change in atmospheric sound absorption;

(B) Atmospheric sound absorption on the change in sound propagation path length; and

(C) Inverse square law on the change in sound propagation path length. The corrected values of SPL are then converted to PNLT from which must be subtracted PNLTM. The resulting difference represents the correction which must be added algebraically to the EPNL calculated from the measured data.

(iii) The minimum distances from both the test and reference profiles to the noise measuring station must be calculated and used to determine a noise duration correction due to any change in the altitude of aircraft flyover. The duration correction must be added algebraically to the EPNL calculated from the measured data.

(iv) From approved data in the form of curves or tables giving the variation of EPNL with engine thrust or test speed, corrections are determined and must be added to the EPNL (which is calculated from the measured data) to account for noise level changes due to differences between test conditions and reference conditions.

(v) From approved data in the form of curves or tables giving the variation of EPNL with approach angle, corrections are determined and must be added algebraically to the EPNL (which is calculated from measured data) to account for noise level changes due to differences between 3 degrees and the test approach angle.

(b) *Takeoff profiles.* (1) Figure A1 illustrates a typical takeoff profile.

(i) The aircraft begins the takeoff roll at point A, lifts off at point B, and initiates the first constant climb at point C at an angle β. The noise abatement thrust cutback is started at point D and completed at point E where the second constant climb is defined by the angle γ (usually expressed in terms of the gradient in percent). The end of the noise certification takeoff flight path is represented by aircraft position F whose vertical projection on the flight track (extended centerline of the runway) is point M. The position of the aircraft must be recorded for the entire interval during which the measured aircraft noise level is within 10 dB of PNLTM. Position K is the takeoff noise measuring station whose distance AK is specified as 3.5 nautical miles. However, if it is necessary to reduce AK to less than 3.5 nautical miles, the procedures prescribed in paragraph (f) of this section must be followed. Position L is the sideline noise measuring station located on a line parallel to, and the prescribed distance from, the runway centerline where the noise level during takeoff is greatest.

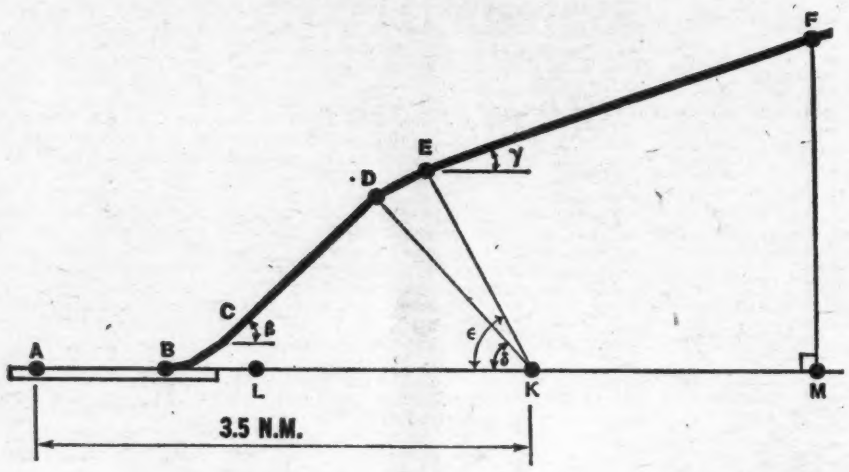


Figure A1. MEASURED TAKEOFF PROFILE

(ii) The takeoff profile is defined by five parameters—(A) AB, the length of takeoff roll; (B) B, the first constant climb angle; (C) γ, the second constant climb angle; and (D) δ, and ϵ, the thrust cutback angles. These five parameters are functions of the aircraft performance and weight, and the atmospheric conditions of temperature, pressure, and wind velocity and direction.

(2) If the test condition do not conform to those prescribed as reference conditions under § A36.5 of this appendix, the corresponding test and reference profile parameters will be different, as shown in Figure A2. The profile parameter changes, identified as $\triangle AB, \triangle B, \triangle\gamma, \triangle\delta$, and $\triangle\epsilon$ may be derived from the manufacturer's data (if approved by the FAA) and may be used to define the flight profile corrected to the reference conditions. The relationships between the measured and corrected takeoff flight profiles may then be used to determine the corrections, which, if positive, must be applied to the EPNL calculated from the measured data.

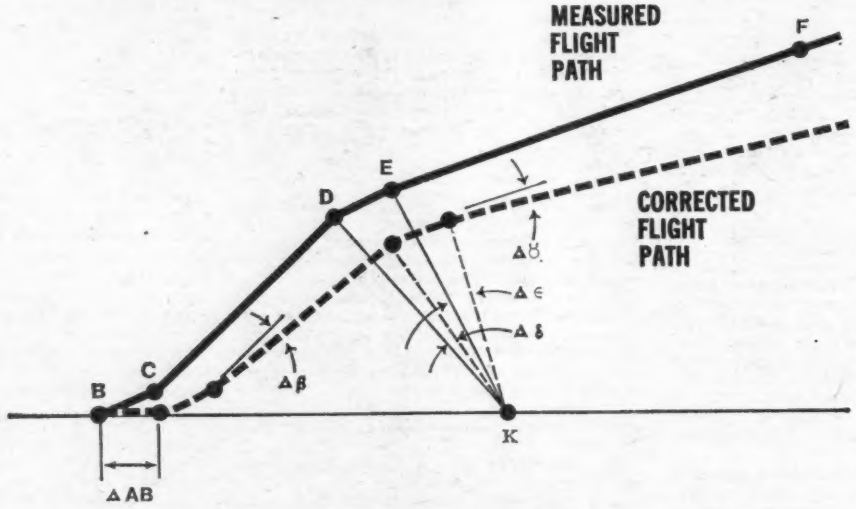


Figure A2. COMPARISON OF MEASURED AND CORRECTED TAKEOFF PROFILES

NOTE: Under reference atmospheric conditions and with maximum takeoff weight, the gradient of the second constant climb angle (γ) may not be less than 4 percent. However, the actual gradient will depend upon the test atmospheric conditions, assuming maximum takeoff weight and the parameters characterizing engine performance are constant (rpm, epr, or any other parameter used by the pilot).

(3) Figure A3 illustrates portions of the measured and corrected takeoff flight paths including the significant geometrical relationships influencing sound propagation. EF represents the measured second constant flight path with climb angle γ, and EcFc rep-

resents the corrected second constant flight path at reduced climb angle $\gamma - \Delta\gamma$. Position Q represents the aircraft location on the measured takeoff flight path for which PNLTM is observed at the noise measuring station K, and Qc is the corresponding position on the corrected flight path. The measured and corrected sound propagation paths are KQ and KQc, respectively, which form the same angle θ with their flight paths. Position R represents the point on the measured takeoff flight path nearest the noise measuring station K, and Rc is the corresponding position on the corrected flight path. The minimum distance to the measured and corrected flight paths are indicated by the lines KR and KRc, respectively, which are normal to their flight paths.

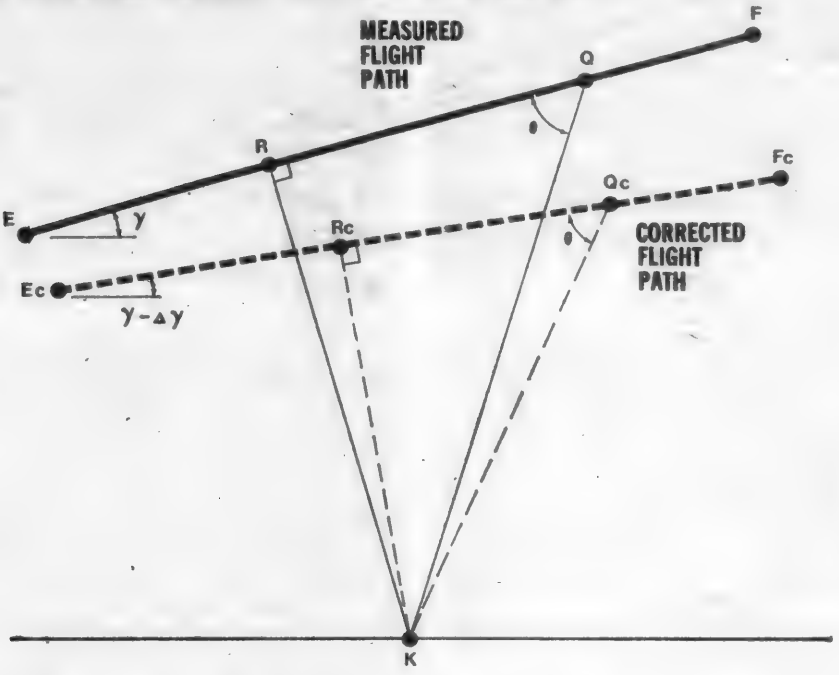


Figure A3. TAKEOFF PROFILE CHARACTERISTICS INFLUENCING SOUND PROPAGATION

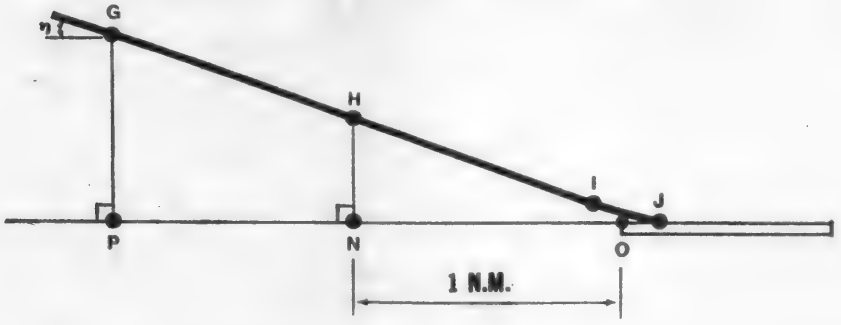


Figure A4. MEASURED APPROACH PROFILE

(c) *Approach profiles.* (1) Figure A4 illustrates a typical approach profile.

(i) The beginning of the noise certification approach profile is represented by aircraft position G whose vertical projected on the flight track (extended centerline of the runway) is point P. The position of the aircraft should be recorded for a distance OP from the runway threshold O to ensure recording of the entire interval during which the measured aircraft noise is within 10 dB of PNLTM.

(ii) The aircraft approaches at an angle η, passes vertically over the noise measuring station N at a height of NH, begins the level off at position I, and touches down at position J. The distance ON is prescribed as 1.0 nautical mile.

(iii) The approach profile is defined by the approach angle η and the height NH which are functions of the aircraft operating conditions controlled by the pilot. If the measured approach profile parameters do not conform to the corresponding reference approach parameters (3 degrees and 370 feet, respectively, as shown in Figure A5), corrections, if positive, must be applied to the EPNL calculated from the measured data.

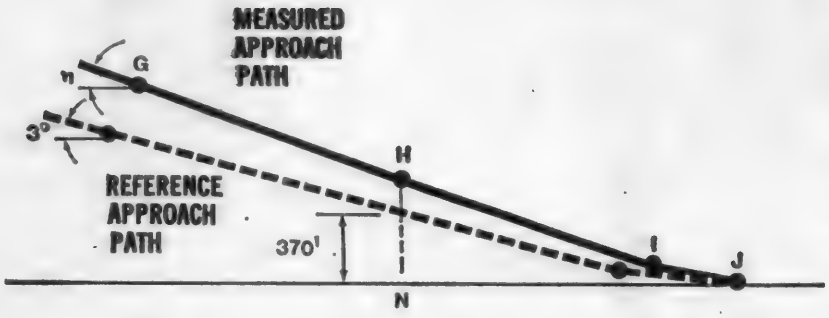


Figure A5. COMPARISON OF MEASURED AND CORRECTED APPROACH PROFILES

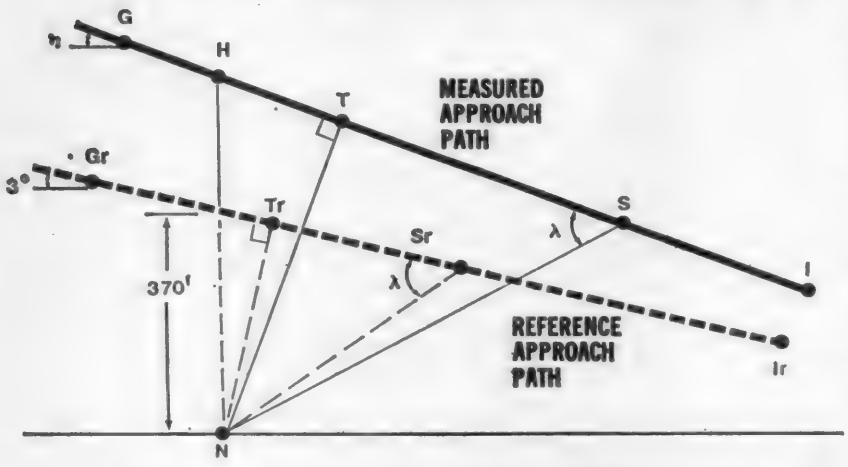


Figure A6. APPROACH PROFILE CHARACTERISTICS INFLUENCING SOUND PROPAGATION

(2) Figure A6 illustrates portions of the measured and reference approach flight paths, including the significant geometrical relationships influencing sound propagation. GI represents the measured approach path with approach angle η, and GrIr represents the reference approach flight path at lower altitude and approach angle of 3 degrees. Position S represents the aircraft location on the measured approach flight path for which PNLTM is observed at the noise measuring station N, and Sr is the corresponding position on the reference approach flight path. The measured and corrected sound propagation paths are NS and NSr, respectively, which form the same angle λ with their flight paths. Position T represents the point on the measured approach flight path nearest the noise measuring station N, and Tr is the corresponding point on the reference approach flight path. The minimum distances to the measured and reference flight paths are indicated by the lines NT and NTr, respectively, which are normal to their flight paths. NOTE: The reference approach flight path is defined by $\eta=3$ degrees and NH=370 feet. Consequently NTr can also be defined; NTr=369 feet to the nearest foot and is, therefore, considered to be one of the reference parameters.

(d) *PNLT corrections.* If the ambient atmospheric conditions of temperature and relative humidity are not those prescribed as reference conditions under § A36.5(c) of this appendix (77 degrees F and 70 percent, respectively), corrections to the EPNL values must be calculated from the measured data under paragraph (a) of this section as follows:

(1) *Takeoff flight path.* For the takeoff flight path shown in Figure A3, the spectrum of PNLTM observed at station K for the aircraft at position Q is decomposed into its individual SPLi values.

(i) *Step 1.* A set of corrected values are then computed as follows:

$$\begin{aligned}SPLic=SPLi \quad &+(oci-ocio)\ KQ\\ &+ocio\ (KQ-KQc)\\ &+20\log\ (KQ/KQc)\end{aligned}$$

where SPLi and SPLic are the measured and corrected sound pressure levels, respectively, in the i-th one-third octave band. The first correction term accounts for the effects of change in atmospheric sound absorption where oci and ocio are the sound absorption coefficients for the test (determined under § A36.9(d)) and reference atmospheric conditions, respectively, for the i-th one-third octave band and KQ is the measured takeoff sound propagation path. The second correction term accounts for the effects of atmospheric sound absorption on the change in the sound propagation path length where KQc is the corrected takeoff sound propagation path. The third correction term accounts for the effects of the inverse square law on the change in the sound propagation path length.

(ii) *Step 2.* The corrected values of SPLic are then converted to PNLT and a correction term calculated as follows:

$$\Delta 1=PNLT-PNLTM$$

which represents the correction to be added algebraically to the EPNL calculated from the measured data.

(2) *Approach flight path.*

(i) The procedure prescribed in paragraph (d)(1) of this section for takeoff flight paths is also used for the approach flight path, except that the value for SPLic relate to the approach sound propagation paths shown in Figure A6 as follows:

$$\begin{aligned}SPLic=SPLi \quad &+(oci-ocio)\ NS\\ &+ocio\ (NS-NSr)\\ &+20\log\ (NS/NSr)\end{aligned}$$

where NS and NSr are the measured and reference approach sound propagation paths, respectively.

(ii) The remainder of the procedure is the same as that prescribed in paragraph (d)(1)(ii) of this section, regarding takeoff flight path.

(3) *Sideline flight path.* The procedure prescribed in paragraph (d)(1) of this section for takeoff flight paths is also used for the sideline flight path, except that the values of SPLic relate only to the measured sideline sound propagation path as follows:

$$\begin{aligned}SPLic=SPLi \quad &+(oci-ocio)\ LX\\ &+oci\ (LXc)\\ &+20\log\ (LX/LXc)\end{aligned}$$

where LX is the measured sideline sound propagation path from station L (Figure A1) to position X of the aircraft for which PNLTM is observed at station L and LXc is the corrected sideline sound propagation path.

(e) *Duration corrections.* If the measured takeoff and approach flight paths do not conform to those prescribed as the corrected and reference flight paths, respectively, it will be necessary, or desirable, to apply duration corrections to the EPNL values calculated from the measured data. Such corrections must be calculated as follows:

(1) *Takeoff flight path.* For the takeoff flight path shown in Figure A3, a correction term is calculated as follows:

$$\Delta 2=-10\log\ (KR/KRc)$$

which represents the correction which must be added algebraically to the EPNL calculated from the measured data. The lengths KR and KRc are the measured and corrected takeoff minimum distances from the noise measuring station K to the measured and the corrected flight paths, respectively. A negative sign indicates that, for the particular case of a duration correction, the EPNL calculated from the measured data must be reduced if the measured flight path is at a greater altitude than the corrected flight path.

(2) *Approach flight path.* The procedure prescribed in paragraph (e)(1) of this section, regarding takeoff flight path duration correction, is also used for the approach flight path duration correction, except that the correction relates to the approach minimum distances (shown in Figure A6) as follows:

$$\Delta 2=-10\log\ (NT/369)$$

where NT is the measured approach minimum distance from the noise measuring station N to the measured flight path and 369 feet is the minimum distance from station N to the reference flight path.

(3) *Sideline flight path.* The duration correction is computed for the sideline flight path as follows:

$$\Delta 2 = -10 \log (LX/LXc)$$

(f) *Nonstandard Takeoff location correction.* All takeoff noise measurements must conducted at the takeoff noise measurement point prescribed in § (36.1 of Appendix C, except where it is necessary to bring the measuring station to a point closer to the start of takeoff roll to ensure recording the complete flyover noise history required by § B36.9 of Appendix B of this part (i.e., a flyover noise/time record which includes the required period before and after the 10 dB-down points from PNLTM). The EPNL value computed from these measurements must be corrected to the value that would have occurred at the 3.5 nautical mile reference measuring point under one of the following procedures:

(1) *Simplified procedure.* Unless the correction factor exceeds 1.0 dB, or the correction results in a final EPNL value which is within 1.5 dB of the noise levels prescribed in Appendix C of this part, the correction procedure prescribed in paragraphs (d) and (e) of this section may be used. Since this procedure accounts for extrapolation of the PNLTM from the close-in-measurement station to the 3.5 nautical miles reference point, corrections for differences between test and reference thrust and velocity must be made after the EPNL has been corrected to the 3.5 nautical mile reference point.

(2) *Integrated procedure.* If the correction factor exceeds 7.0 dB, or the correction results in final a EPNL value which is within 1.5 dB of the noise levels prescribed in Appendix C of this part, the following correction procedure must be used:

(i) Each ½ second spectra measured during a flyover at a noise measuring station which is closer to the flight path than the prescribed reference distance must be adjusted under a procedure similar to that prescribed under paragraph (d) (1) of this section, regarding PNLT corrections. However, the distances which must be used are those values of KQ and KQc for the sound propagation path (and hence value of θ) for PNLTM which represents the actual, measured sound propagation path (and path angle), and the corresponding sound propagation path (and path angle) as if the measurements had been made at the 3.5 nautical mile measuring point under reference acoustic-day conditions.

(ii) After the measured ½-second spectra have been corrected to the 3.5 nautical mile reference point, the remaining noise evaluation must be conducted under the procedures prescribed in Appendix B of this part, including the appropriate reference thrust and velocity corrections.

APPENDIX B

3. The heading to Appendix B would be amended to add a table of sections reading as follows:

APPENDIX B—AIRCRAFT NOISE EVALUATION UNDER § 36.103

Sec.
B36.1 *General.*
B36.3 *Perceived noise level.*
B36.5 *Correction for spectral irregularities.*
B36.7 *Maximum tone corrected perceived noise level.*
B36.9 *Duration correction.*
B36.11 *Effective perceived noise level.*
B36.13 *Mathematical formulation of noy tables.*

4. § B36.2 would be amended as follows:

a. Redesignate § B36.2 as "§ B36.3".

b. Designate steps 1, 2, and 3 as paragraphs "(a) *Step 1.,*" (b) *Step 2.,*" and "(c) *Step 3.,*" respectively.

c. At the end of Step 1. of the prescribed procedure, substitute the reference "§ B36.13 of this appendix" for "§ B36.7 of this Appendix."

5. § B36.3 would be amended as follows:

a. Redesignate § B36.3 as "§ B36.5."

b. Designate Steps 1 through 10 of the prescribed procedure as paragraphs "(a) *Step 1.*" through "(j) *Step 10.*", consecutively.

c. In Step 3 of the prescribed procedure, redesignate paragraphs (a), (b), and (c) as paragraphs "(1)," "(2)," and "(3)," respectively.

d. In Step 4 of the prescribed procedure, redesignate paragraphs (a), (b), and (c) as paragraphs "(1)," "(2)," and "(3)," respectively.

e. Designate the last two undesignated paragraphs of the section as paragraphs "(k)," and "(l)," consecutively.

f. At the end of the current text of the section add two new paragraphs, designated "(m)," and "(n)," to read as follows:

(m) Tones resulting from ground-plane reflections in the 800 Hz and lower one-third octave bands may be excluded from the calculation of corrections for spectral irregularities. To qualify for this exclusion, the pseudotones must be clearly identified as not being related to the engine noise. This identification may be made either by comparing measured data with data from a flush-mounted microphone, or by observing the Dopper shift characteristics of the tone during the flyover-noise/time history. Since pseudotones are related to ground reflections, a microphone mounted flush to the ground will yield a spectral shape which can be distinguished from that produced by the 4-foot high microphone at those frequencies which can be related to ground reflection's geometrical relationships. Identification through Doppler shifting (the symmetric variation of frequency with time) can be made because the Doppler frequency variation yields a frequency increase for an approaching signal and a frequency decrease for a receding signal. Pseudotones at frequencies above 800 Hz generally should not yield significant tone corrections. However, for consistency, each tone correction value must be included in the computation for spectral irregularities. While the tone corrections below 800 Hz may be ignored for the spectral irregularity correction, the SPL values must be included in the noy calculation prescribed in § B36.13 of this appendix.

(n) After the value of PNLTM for each flyover-noise/time history, is identified, the level difference, F for PNLTM, the time of its occurrence (k), and the frequency for the largest tone correction factor (C(k)) must be identified and displayed for the two preceding, and the two succeeding, 500-millisecond time intervals. The display must be evaluated by comparison of successive values of the tone correction parameters to identify possible tone suppression at PNLTM as a result of band sharing of the tone. If band sharing is identified, the value of F for PNLTM must be established by a faired curve through the five successive time intervals, which do not include the specific interval (or intervals) which has been identified as associated with the tone band.

6. § B36.4 would be amended as follows:

a. Redesignate § B36.4 as "§ B36.7."

b. Designate the two undesignated paragraphs as paragraphs "(a)" and "(b)," consecutively.

c. In the sixth line of the first undesignated paragraph, and in the second and third lines of the second undesignated paragraph, in each case substitute the reference "B36.5 of this appendix" for "B36.3 of this appendix."

7. § B36.5 would be amended as follows:

a. Redesignate § B36.5 as "§ B36.9."

b. Designate the six undesignated paragraphs as paragraphs "(a)" through "(f)," consecutively.

8. § B36.6 would be amended as follows:

a. Redesignate § B36.6 as "§ B36.11."

b. Designate the two undesignated paragraphs as paragraphs "(a)" and "(b)," consecutively.

c. In the last line of the first undesignated paragraph, substitute the reference "B36.7 and B36.9 of this appendix" for "B36.4 and B36.5 of this appendix."

d. In the second and third line of the second undesignated paragraph, substitute the reference "B36.9 of this appendix" for "B36.5 of this appendix."

9. § B36.7 would be amended as follows:

a. Redesignate § B36.7 as "§ B36.13."

b. Designate the 3 undesignated paragraphs as paragraphs "(a)," "(b)," and "(c)," consecutively.

10. Three tables contained in Appendix B would be amended by substituting the following tables for Table B1, Table B2, and Table B3, respectively.

TABLE B1 - PERCEIVED NOISINESS (NOYs) AS A FUNCTION OF SOUND PRESSURE LEVEL

	1/3 OCTAVE BAND CENTER FREQUENCIES IN Hz (c/s)																						
SPL	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000
8																			0.10					
9																		0.10	0.11	0.10				
10																		0.11	0.12	0.11	0.10			
11																		0.12	0.14	0.13	0.11			
12																		0.14	0.16	0.14	0.13			
13																	0.10	0.16	0.17	0.16	0.14			
14																	0.11	0.17	0.19	0.18	0.16	0.10		
15																	0.13	0.19	0.21	0.21	0.18	0.12		
16																0.10	0.14	0.21	0.24	0.24	0.21	0.14		
17																0.11	0.16	0.24	0.27	0.27	0.24	0.16		
18																0.13	0.18	0.27	0.30	0.30	0.27	0.19		
19															0.10	0.14	0.21	0.30	0.33	0.33	0.30	0.22		
20															0.11	0.16	0.24	0.33	0.35	0.35	0.33	0.26		
21															0.13	0.18	0.27	0.35	0.38	0.38	0.35	0.30	0.10	
22															0.15	0.21	0.30	0.38	0.41	0.41	0.38	0.33	0.12	
23															0.17	0.24	0.33	0.41	0.45	0.45	0.41	0.36	0.14	
24															0.20	0.27	0.36	0.45	0.49	0.49	0.45	0.39	0.17	
25															0.23	0.30	0.39	0.49	0.53	0.53	0.49	0.42	0.21	0.10
26															0.26	0.33	0.42	0.53	0.57	0.57	0.53	0.46	0.25	0.11
27															0.30	0.36	0.46	0.57	0.61	0.61	0.57	0.50	0.30	0.13
28															0.34	0.40	0.50	0.62	0.67	0.67	0.62	0.55	0.33	0.15
29															0.39	0.43	0.55	0.67	0.73	0.73	0.67	0.60	0.36	0.17
30															0.44	0.48	0.60	0.73	0.79	0.79	0.73	0.65	0.39	0.20
31															0.50	0.52	0.65	0.79	0.85	0.85	0.79	0.71	0.43	0.23
32															0.57	0.57	0.71	0.85	0.92	0.92	0.85	0.77	0.46	0.26
33															0.64	0.63	0.77	0.92	1.00	1.00	0.92	0.84	0.50	0.30
34															0.73	0.69	0.84	1.00	1.07	1.07	1.00	0.92	0.55	0.33
35															0.83	0.76	0.92	1.07	1.15	1.15	1.07	1.00	0.60	0.37
36															0.94	0.83	1.00	1.15	1.23	1.23	1.15	1.07	0.65	0.41
37															1.07	0.91	1.07	1.23	1.32	1.32	1.23	1.15	0.71	0.45
38															1.23	1.00	1.15	1.32	1.41	1.41	1.32	1.23	0.77	0.50
39															1.41	1.07	1.23	1.41	1.51	1.51	1.41	1.32	0.84	0.55
40															1.62	1.15	1.32	1.51	1.62	1.62	1.51	1.41	0.92	0.61
41															1.86	1.23	1.41	1.62	1.74	1.74	1.62	1.51	1.00	0.67
42															2.14	1.32	1.51	1.74	1.86	1.86	1.74	1.62	1.10	0.74
43															2.45	1.41	1.62	1.86	1.99	1.99	1.86	1.74	1.21	0.82
44															2.81	1.51	1.74	1.99	2.14	2.14	1.99	1.86	1.34	0.90
45															3.23	1.62	1.86	2.14	2.29	2.29	2.14	1.99	1.48	1.00
46															3.71	1.74	1.99	2.29	2.45	2.45	2.29	2.14	1.63	1.10
47															4.27	1.86	2.14	2.45	2.63	2.63	2.45	2.29	1.79	1.21
48															4.91	1.99	2.29	2.63	2.81	2.81	2.63	2.45	1.99	1.34
49															5.65	2.14	2.45	2.81	3.02	3.02	2.81	2.63	2.14	1.48
46															6.49	2.29	2.63	3.02	3.23	3.23	3.02	2.81	2.29	1.63
47															7.47	2.45	2.81	3.23	3.46	3.46	3.23	3.02	2.45	1.79
48															8.59	2.63	3.02	3.46	3.71	3.71	3.46	3.23	2.63	1.98
49															9.88	2.81	3.23	3.71	3.97	3.97	3.71	3.46	2.81	2.18

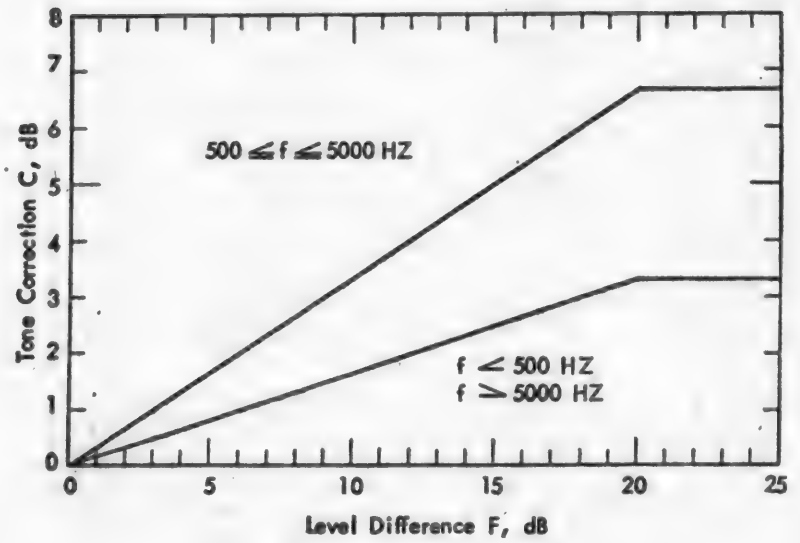
TABLE B1 CONTINUED

	⅓ OCTAVE BAND CENTER FREQUENCIES IN Hz (c/s)																						
SPL	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000
30	.12	.26	.49	.72	.90	1.17	1.36	1.56	1.76	2.00	2.00	2.00	2.00	2.00	2.20	3.00	3.46	3.97	4.26	4.26	3.97	3.71	3.00	2.40
31	.14	.30	.55	.80	1.00	1.28	1.47	1.68	1.89	2.14	2.14	2.14	2.14	2.14	2.46	3.23	3.71	4.26	4.56	4.56	4.26	3.97	3.23	2.61
32	.17	.34	.62	.90	1.09	1.36	1.58	1.80	2.03	2.30	2.30	2.30	2.30	2.30	2.64	3.46	3.97	4.56	4.89	4.89	4.56	4.26	3.46	2.81
33	.21	.39	.70	1.00	1.18	1.47	1.71	1.94	2.17	2.46	2.46	2.46	2.46	2.46	2.83	3.71	4.26	4.89	5.24	5.24	4.89	4.56	3.71	3.02
34	.25	.45	.79	1.09	1.28	1.58	1.85	2.09	2.33	2.64	2.64	2.64	2.64	2.64	3.03	3.97	4.56	5.24	5.61	5.61	5.24	4.89	3.97	3.23
35	.30	.51	.89	1.18	1.38	1.71	2.00	2.25	2.50	2.83	2.83	2.83	2.83	2.83	3.25	4.26	4.89	5.61	6.01	6.01	5.61	5.24	4.26	3.46
36	.35	.59	1.00	1.23	1.50	1.85	2.15	2.42	2.69	3.03	3.03	3.03	3.03	3.03	3.48	4.56	5.24	6.01	6.44	6.44	6.01	5.61	4.56	3.71
37	.39	.67	1.09	1.38	1.63	2.00	2.33	2.61	2.88	3.25	3.25	3.25	3.25	3.25	3.73	4.89	5.61	6.44	6.90	6.90	6.44	6.01	4.89	3.97
38	.45	.77	1.18	1.52	1.77	2.15	2.51	2.81	3.10	3.48	3.48	3.48	3.48	3.48	4.00	5.24	6.01	6.90	7.39	7.39	6.90	6.44	5.24	4.26
39	.51	.87	1.29	1.66	1.92	2.33	2.71	3.03	3.32	3.73	3.73	3.73	3.73	3.73	4.29	5.61	6.44	7.39	7.92	7.92	7.39	6.90	5.61	4.56
40	.59	1.00	1.48	1.91	2.21	2.51	2.92	3.25	3.57	4.00	4.00	4.00	4.00	4.00	4.59	6.01	6.90	7.92	8.49	8.49	7.92	7.39	6.01	4.89
41	.67	1.00	1.51	1.97	2.36	2.71	3.16	3.51	3.85	4.29	4.29	4.29	4.29	4.29	4.92	6.44	7.39	8.49	9.09	9.09	8.49	7.92	6.44	5.24
42	.77	1.21	1.62	2.15	2.54	2.71	3.41	3.79	4.11	4.59	4.59	4.59	4.59	4.59	5.28	6.90	7.92	9.09	9.74	9.74	9.09	8.49	6.90	5.61
43	.87	1.32	1.91	2.34	2.65	3.16	3.63	4.06	4.41	4.92	4.92	4.92	4.92	4.92	5.66	7.39	8.49	9.74	10.4	10.4	9.74	9.09	7.39	6.01
44	1.00	1.45	1.97	2.54	2.88	3.41	3.98	4.39	4.73	5.28	5.28	5.28	5.28	5.28	6.06	7.92	9.09	10.4	11.2	11.2	10.4	9.74	7.92	6.44
45	1.11	1.60	2.15	2.77	3.12	3.69	4.26	4.71	5.08	5.66	5.66	5.66	5.66	5.66	6.50	8.49	9.74	11.2	12.0	12.0	11.2	10.4	8.49	6.90
46	1.22	1.72	2.34	3.01	3.39	3.91	4.64	5.07	5.45	6.06	6.06	6.06	6.06	6.06	6.96	9.09	10.4	12.0	12.8	12.8	12.0	11.2	9.09	7.39
47	1.34	1.86	2.54	3.29	3.68	4.28	5.01	5.48	5.89	6.50	6.50	6.50	6.50	6.50	7.46	9.74	11.2	12.8	13.8	13.8	12.8	12.0	9.74	7.92
48	1.48	2.01	2.77	3.57	3.99	4.64	5.41	5.89	6.27	6.96	6.96	6.96	6.96	6.96	8.00	10.4	12.0	13.8	14.7	14.7	13.8	12.8	10.4	8.49
49	1.65	2.32	3.01	3.98	4.33	5.01	5.84	6.33	6.77	7.46	7.46	7.46	7.46	7.46	8.57	11.2	12.8	14.7	15.8	15.8	14.7	13.8	11.2	9.09
50	1.82	2.58	3.28	4.22	4.69	5.41	6.31	6.81	7.23	8.00	8.00	8.00	8.00	8.00	9.19	12.0	13.8	15.8	16.9	16.9	15.8	14.7	12.0	9.74
51	2.02	2.79	3.57	4.66	5.09	5.84	6.81	7.32	7.75	8.57	8.57	8.57	8.57	8.57	9.85	12.8	14.7	16.9	18.1	18.1	16.9	15.8	12.8	10.4
52	2.23	3.07	3.88	5.01	5.52	6.31	7.36	7.88	8.32	9.19	9.19	9.19	9.19	9.19	10.6	13.8	15.8	18.1	19.4	19.4	18.1	16.9	13.8	11.2
53	2.48	3.37	4.23	5.45	5.98	6.81	7.96	8.50	8.95	9.85	9.85	9.85	9.85	9.85	11.3	14.7	16.9	19.4	20.8	20.8	19.4	18.1	14.7	12.0
54	2.72	3.70	4.80	5.94	6.50	7.36	8.57	9.15	9.59	10.6	10.6	10.6	10.6	10.6	12.1	15.8	18.1	20.9	22.3	22.3	20.8	19.4	15.8	12.8
55	3.01	4.06	5.01	6.46	7.05	7.94	9.19	9.85	10.3	11.3	11.3	11.3	11.3	11.3	13.0	16.9	19.4	22.3	23.9	23.9	22.3	20.9	16.9	13.8
56	3.32	4.46	5.45	7.03	7.65	8.57	9.85	10.8	11.0	12.1	12.1	12.1	12.1	12.1	13.9	18.1	20.8	23.9	25.6	25.6	23.9	22.3	18.1	14.7
57	3.67	4.89	5.94	7.66	8.29	9.19	10.6	11.3	11.8	13.0	13.0	13.0	13.0	13.0	14.9	19.4	22.3	25.6	27.4	27.4	25.6	23.9	19.4	15.8
58	4.06	5.37	6.46	8.33	9.00	9.85	11.3	12.1	12.7	13.9	13.9	13.9	13.9	13.9	16.0	20.8	23.9	27.4	29.4	29.4	27.4	25.6	20.8	16.9
59	4.49	5.90	7.03	9.07	9.78	10.6	12.1	13.0	13.6	14.9	14.9	14.9	14.9	14.9	17.1	22.3	25.6	29.4	31.5	31.5	29.4	27.4	22.3	18.1
60	4.96	6.49	7.66	9.85	10.6	11.3	13.0	13.9	14.6	16.0	16.0	16.0	16.0	16.0	18.4	23.9	27.4	31.5	33.7	33.7	31.5	29.4	23.9	19.4
61	5.48	7.11	8.33	10.8	11.3	12.1	13.9	14.9	15.7	17.1	17.1	17.1	17.1	17.1	19.7	25.6	29.4	33.7	36.1	36.1	33.7	31.5	25.6	20.8
62	6.06	7.81	9.07	11.3	12.1	13.0	14.9	16.0	16.5	18.4	18.4	18.4	18.4	18.4	21.1	27.4	31.5	36.1	38.7	38.7	36.1	33.7	27.4	22.3
63	6.70	8.57	9.87	12.1	13.0	13.9	16.0	17.1	18.1	19.7	19.7	19.7	19.7	19.7	22.6	29.4	33.7	38.7	41.5	41.5	38.7	36.1	29.4	23.9
64	7.41	9.41	10.7	13.0	13.9	14.9	17.1	18.4	19.4	21.1	21.1	21.1	21.1	21.1	24.3	31.5	36.1	41.5	44.4	44.4	41.5	38.7	31.5	25.6
65	8.19	10.3	11.7	13.9	14.8	16.0	18.4	19.7	20.8	22.6	22.6	22.6	22.6	22.6	26.0	33.7	38.7	44.4	47.6	47.6	44.4	41.5	33.7	27.4
66	9.05	11.3	12.7	14.9	16.0	17.1	19.7	21.1	22.4	24.3	24.3	24.3	24.3	24.3	27.9	36.1	41.5	47.6	51.0	51.0	47.6	44.4	36.1	29.4
67	10.0	12.1	13.9	16.0	17.1	18.4	21.1	22.6	24.0	26.0	26.0	26.0	26.0	26.0	29.9	38.7	44.4	51.0	54.7	54.7	51.0	47.6	38.7	31.5
68	11.1	13.0	14.9	17.1	18.4	19.7	22.6	24.3	25.8	27.9	27.9	27.9	27.9	27.9	32.0	41.5	47.6	54.7	58.6	58.6	54.7	51.0	41.5	33.7
69	12.2	13.9	16.0	18.4	19.7	21.1	24.3	26.0	27.7	29.9	29.9	29.9	29.9	29.9	34.3	44.4	51.0	58.6	62.7	62.7	58.6	54.7	44.4	36.1
70	13.5	14.9	17.1	19.7	21.1	22.6	26.0	27.9	29.7	32.0	32.0	32.0	32.0	32.0	36.8	47.6	54.7	62.7	67.2	67.2	62.7	58.6	47.6	38.7
71	14.9	16.0	18.4	21.1	22.6	24.3	27.9	29.9	31.8	34.3	34.3	34.3	34.3	34.3	39.4	51.0	58.6	67.2	72.0	72.0	67.2	62.7	51.0	41.5
72	16.0	17.1	19.7	22.6	24.3	26.0	29.9	32.0	34.2	36.8	36.8	36.8	36.8	36.8	42.2	54.7	62.7	72.0	77.3	77.2	72.0	67.2	54.7	44.4
73	17.1	18.4	21.1	24.3	26.0	27.9	32.0	34.3	36.7	39.4	39.4	39.4	39.4	39.4	45.3	58.6	67.2	77.2	82.7	82.7	77.2	72.0	58.6	47.6
74	18.4	19.7	22.6	26.0	27.9	29.9	34.3	36.8	39.4	42.2	42.2	42.2	42.2	42.2	48.5	62.7	72.0	82.7	88.6	88.6	82.7	77.2	62.7	51.0
75	19.7	21.1	24.3	27.9	29.9	32.0	36.8	39.4	42.2	45.3	45.3	45.3	45.3	45.3	52.0	67.2	77.2	88.6	94.9	94.9	88.6	82.7	67.2	54.7
76	21.1	22.6	26.0	29.9	32.0	34.3	39.4	42.2	45.3	48.5	48.5	48.5	48.5	48.5	55.7	72.0	82.7	94.9	102	102	94.9	88.6	72.0	58.6
77	22.6	24.3	27.9	32.0	34.3	36.8	42.2	45.3	48.5	52.0	52.0	52.0	52.0	52.0	59.7	77.2	88.6	102	109	109	102	94.9	77.2	62.7
78	24.3	26.0	29.9	34.3	36.8	39.4	45.3	48.5	52.0	55.7	55.7	55.7	55.7	55.7	64.0	82.7	94.9	109	117	117	109	102	82.7	67.2
79	26.0	27.9	32.0	36.8	39.4	42.2	48.5	52.0	55.7	59.7	59.7	59.7	59.7	59.7	68.6	88.6	102	117	125	125	117	109	88.6	72.0

TABLE B1 CONTINUED

SPL	1/3 OCTAVE BAND CENTER FREQUENCIES IN Hz (c/s)																					
	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000
100	27.9	29.9	34.2	39.4	45.2	45.3	51.8	55.7	59.7	64.0	64.0	64.0	64.0	64.0	73.5	94.9	109	125	134	134	125	117	94.9	77.2
101	29.5	32.0	36.8	42.2	48.5	48.5	55.7	59.7	64.0	68.6	68.6	68.6	73.5	78.8	78.8	102	117	134	144	144	134	125	102	84.7
102	32.0	34.3	39.4	45.3	48.5	52.0	59.7	64.0	68.6	73.5	73.5	73.5	78.8	84.4	84.4	109	125	144	154	154	144	134	109	84.6
103	34.3	36.8	42.2	48.5	52.0	55.7	64.0	68.6	73.5	78.8	78.8	78.8	84.4	90.5	90.5	117	134	154	165	165	154	144	117	94.9
104	36.8	39.4	45.3	52.0	55.7	55.7	68.6	73.5	78.8	84.4	84.4	84.4	90.5	97.0	97.0	125	144	165	177	177	165	154	125	102
105	39.4	42.2	48.5	55.7	59.7	64.0	73.5	78.8	84.4	90.5	90.5	90.5	90.5	90.5	104	134	154	177	189	189	177	165	134	109
106	42.2	45.3	52.0	59.7	64.0	68.6	78.8	84.4	90.5	97.0	97.0	97.0	97.0	97.0	111	144	165	189	203	203	189	177	144	117
107	45.3	48.5	55.7	64.0	68.6	73.5	84.4	90.5	97.0	104	104	104	104	104	119	154	177	203	217	217	203	189	154	125
108	48.5	52.0	59.7	68.6	73.5	78.8	90.5	97.0	104	111	111	111	111	111	128	165	189	217	233	233	217	203	165	134
109	52.0	55.7	64.0	73.5	78.8	84.4	97.0	104	111	119	119	119	119	119	137	177	203	233	249	249	233	217	177	144
110	55.7	59.7	68.6	78.8	84.4	90.5	104	111	119	128	128	128	128	128	147	189	217	249	267	267	249	233	189	154
111	59.7	64.0	73.5	84.4	90.5	97.0	111	119	128	137	137	137	137	137	158	203	233	267	286	286	267	249	203	165
112	64.0	68.6	78.8	90.5	97.0	104	119	128	137	147	147	147	147	147	169	217	249	286	307	307	286	267	217	177
113	68.6	73.5	84.4	97.0	104	111	128	137	147	158	158	158	158	158	181	233	267	307	329	329	307	286	233	189
114	73.5	78.8	90.5	104	111	119	137	147	158	169	169	169	169	169	194	249	286	329	352	352	329	307	249	203
115	78.8	84.4	97.0	111	119	128	147	158	169	181	181	181	181	181	208	267	307	352	377	377	352	329	267	217
116	84.4	90.5	104	119	128	137	158	169	181	194	194	194	194	194	223	286	329	377	404	404	377	352	286	233
117	90.5	97.0	111	128	137	147	169	181	194	208	208	208	208	208	239	307	352	377	404	433	404	377	307	249
118	97.0	104	119	137	147	158	181	194	208	223	223	223	223	223	256	329	377	404	433	464	433	404	329	267
119	104	111	128	147	158	169	194	208	223	239	239	239	239	239	274	352	404	433	464	497	464	433	352	286
120	111	119	137	158	169	181	208	223	239	256	256	256	256	256	294	377	433	464	497	533	497	464	377	307
121	119	128	147	169	181	194	223	239	256	274	274	274	274	274	315	404	464	497	533	571	533	497	404	329
122	128	137	158	181	194	208	239	256	274	294	294	294	294	294	339	433	497	533	571	611	571	533	433	352
123	137	147	169	194	208	223	256	274	294	315	315	315	315	315	362	464	533	571	611	655	611	571	464	377
124	147	158	181	208	223	239	274	294	315	339	339	339	339	339	388	497	571	611	655	702	655	611	497	404
125	158	169	194	223	239	256	294	315	339	362	362	362	362	362	416	533	611	702	752	752	702	655	533	433
126	169	181	208	239	256	274	315	339	362	388	388	388	388	388	446	571	655	752	806	806	752	702	571	464
127	181	194	223	256	274	294	339	362	388	416	416	416	416	416	478	611	702	806	863	863	806	752	611	497
128	194	208	239	274	294	315	362	388	416	446	446	446	446	446	512	655	752	863	925	925	863	806	655	533
129	208	223	256	294	315	339	388	416	446	478	478	478	478	478	549	702	806	925	991	991	925	863	702	571
130	223	239	274	315	339	362	416	446	478	512	512	512	512	512	588	752	863	991	1062	1062	991	925	752	611
131	239	256	294	339	362	388	446	478	512	549	549	549	549	549	630	806	925	1062	1137	1137	1062	991	806	655
132	256	274	315	362	388	416	478	512	549	588	588	588	588	588	676	863	991	1137	1219	1219	1137	1062	863	702
133	274	294	339	388	416	446	512	549	588	630	630	630	630	630	724	925	1062	1219	1306	1306	1219	1137	925	752
134	294	315	362	416	446	478	549	588	630	676	676	676	676	676	776	991	1137	1306	1399	1399	1306	1219	991	806
135	315	338	388	446	478	512	588	630	676	724	724	724	724	724	832	1062	1219	1399	1499	1499	1399	1306	1062	863
136	338	362	416	478	512	549	630	676	724	776	776	776	776	776	891	1137	1306	1499	1606	1606	1499	1399	1137	925
137	362	388	446	512	549	588	676	724	776	832	832	832	832	832	955	1219	1399	1606	1721	1721	1606	1499	1219	991
138	388	416	478	549	588	630	724	776	832	891	891	891	891	891	1024	1306	1499	1721	1844	1844	1721	1606	1306	1062
139	416	446	512	588	630	676	776	832	891	955	955	955	955	955	1096	1399	1606	1844	1975	1975	1844	1721	1399	1137
140	446	478	549	630	676	724	832	891	955	1024	1024	1024	1024	1024	1176	1499	1721	1975			1975	1844	1499	1219
141	478	512	588	676	724	776	891	955	1024	1096	1096	1096	1096	1096	1261	1606	1844					1975	1606	1306
142	512	549	630	724	776	832	955	1024	1096	1176	1176	1176	1176	1176	1351	1721	1975						1721	1399
143	549	588	676	776	832	891	1024	1096	1176	1261	1261	1261	1261	1261	1448	1844							1844	1499
144	588	630	724	832	891	955	1096	1176	1261	1351	1351	1351	1351	1351	1552	1975							1975	1606
145	630	676	776	891	955	1024	1176	1261	1351	1448	1448	1448	1448	1448	1664									1721
146	676	724	832	955	1024	1096	1261	1351	1448	1552	1552	1552	1552	1552	1783									1844
147	724	776	891	1024	1096	1176	1351	1448	1552	1664	1664	1664	1664	1664	1911									1975
148	776	832	955	1096	1176	1261	1448	1552	1664	1783	1783	1783	1783	1783	2048									
149	832	891	1024	1176	1261	1351	1552	1664	1783	1911	1911	1911	1911	1911										
150	891	955	1096	1261	1351	1448	1664	1783	1911	2048	2048	2048	2048	2048										

TABLE B2. Tone correction factors.



Frequency f, HZ	Level Difference F, dB	Tone Correction C, dB
50 ≤ f < 500	0 ≤ F < 20 20 ≤ F	F/6 3 1/3
500 ≤ f ≤ 5000	0 ≤ F < 20 20 ≤ F	F/3 6 2/3
5000 < f ≤ 10000	0 ≤ F < 20 20 ≤ F	F/6 3 1/3

TABLE B3. Example of tone correction calculation for a turbofan engine.

① Band (i)	② f HZ	③ SPL dB	④ S dB Step 1	⑤ |ΔS| dB Step 2	⑥ SPL' dB Step 4	⑦ S' dB Step 5	⑧ $\bar{S}$ dB Step 6	⑨ SPL'' dB Step 7	⑩ F dB Step 8	⑪ C dB Step 9
1	50	-	-	-	-	-	-	-	-	-
2	63	-	-	-	-	-	-	-	-	-
3	80	70	-	-	70	-8	-2 1/3	70	-	
4	100	62	- 8	-	62	-8	+3 1/3	67 2/3	-	
5	125	(70)	+(8)	16	71	+9	+6 2/3	71	-	
6	160	80	+10	2	80	+9	+2 2/3	77 2/3	2 1/3	1/3
7	200	82	+(2)	8	82	+2	-1 1/3	80 1/3	1 2/3	1/3
8	250	(83)	+ 1	1	79	-3	-1 1/3	79	4	2/3
9	315	76	-(7)	8	76	-3	+ 1/3	77 2/3	-	
10	400	(80)	+(4)	11	78	+2	+1	78	2	1/3
11	500	80	0	4	80	+2	0	79	1	1/3
12	630	79	- 1	1	79	-1	0	79	-	
13	800	78	- 1	0	78	-1	- 1/3	79	-	
14	1000	80	+ 2	3	80	+2	- 2/3	78 2/3	1 1/3	1/3
15	1250	78	- 2	4	78	-2	- 1/3	78	-	
16	1600	76	- 2	0	76	-2	+ 1/3	77 2/3	-	
17	2000	79	+ 3	5	79	+3	+1	78	1	1/3
18	2500	(85)	+ 6	3	79	0	- 1/3	79	6	[2]
19	3150	79	-(6)	12	79	0	-2 2/3	78 2/3	1/3	0
20	4000	78	- 1	5	78	-1	-6 1/3	76	2	2/3
21	5000	71	-(7)	6	71	-7	-8	69 2/3	1 1/3	1/3
22	6300	60	-11	4	60	-11	-8 2/3	61 2/3	-	
23	8000	54	- 6	5	54	-6	-8	53	1	0
24	10000	45	- 9	3	45	-9	-	45	-	
						-9				

Step 1	③ (i) - ③ (i-1)
Step 2	|④ (i) - ④ (i-1)|
Step 3	see instructions
Step 4	see instructions
Step 5	⑥ (i) - ⑥ (i-1)

Step 6	[⑦ (i) + ⑦ (i+1) + ⑦ (i+2)] ÷ 3
Step 7	⑨ (i-1) + ⑧ (i-1)
Step 8	③ (i) - ⑨ (i)
Step 9	see Table B2

APPENDIX C

11. The heading to Appendix C would be amended to add a table of sections reading as follows:

APPENDIX C—NOISE LEVELS FOR SUBSONIC TRANSPORT CATEGORY AND TURBOJET POWERED AIRPLANES UNDER SECTION 36.201

Sec.
C36.1 Noise measurement and evaluation.
C36.3 Noise measuring points.
C36.5 Noise levels.
C36.7 Takeoff test conditions.
C36.9 Approach test conditions.

APPENDIX F

11. The heading to Appendix F would be amended to add a table of units and sections reading as follows:

APPENDIX F—NOISE REQUIREMENTS FOR PROPELLER-DRIVEN SMALL AIRPLANES

PART A—GENERAL

Sec.
F36.1 Scope.

PART B—NOISE MEASUREMENT

Sec.
F36.101 General test conditions.
F36.103 Acoustical measurement system.
F36.105 Sensing, recording, and reproducing equipment.
F36.107 Noise measurement procedures.
F36.109 Data recording, reporting, and approval.
F36.111 Flight procedures.

PART C—DATA CORRECTION

Sec.
F36.201 Correction of data.
F36.203 Validity of results.

PART D—NOISE LIMITS

Sec.
F36.301 Aircraft noise limits.

13. Paragraph (b) of § F36.105 would be revised to read as follows:

§ F36.105 *Sensing, recording, and reproducing equipment.*

* * * * *

(b) The characteristics of the system must comply with the recommendations in International Electrochemical Commission (IEC) Publication No. 179, dated 1973. IEC Publication No. 179, dated 1973 and entitled "Precision Sound Level Meters" is incorporated by reference in Part 36 under § 36.9 of this part.

Issued in Washington, D.C., on October 19, 1976.

CHARLES R. FOSTER,
Director of Environmental Quality.

[FR Doc.76-31205 Filed 10-27-76;8:45 am]

[14 CFR Part 36]

[Docket No. 16231; Notice No. 76-22]

NOISE STANDARDS: AIRCRAFT TYPE AND AIRWORTHINESS CERTIFICATION

Proposed Regulations Submitted to the FAA by the Environmental Protection Agency; Noise Levels for Turbojet Engine Powered Airplanes and for Transport Category Large Airplanes

This notice of proposed rule making contains recommended regulations submitted by the Environmental Protection Agency (EPA) to the Federal Aviation Administration (FAA), pursuant to § 611 (c)(1) of the Federal Aviation Act of 1958, as amended by the Noise Control Act of 1972 (Pub. L. 92-574). Section 611 (c)(1) of the Federal Aviation Act of 1958 provides that EPA shall submit to the FAA recommended regulations to provide such control and abatement of aircraft noise and sonic boom as EPA determines is necessary to protect the public health and welfare. That section also provides that the FAA "shall consider such proposed regulations submitted by EPA under this paragraph and shall, within thirty days of its submission to the FAA, publish the proposed regulations in a notice of proposed rulemaking." This notice is published pursuant to that provision of law.

The EPA recommended regulation contained in this notice of proposed rule making (NPRM) proposes to amend Part 36 of the Federal Aviation Regulations (14 CFR Part 36) to prescribe reduced noise level limits that would be applicable to airplanes for which application is made—(1) for certain acoustical change approvals, after November 5, 1975; (2) for new type certificates, after December 31, 1979; and (3) for new type certificates after December 31, 1984. The EPA proposal contains more restrictive standards for acoustical changes to airplanes which, prior to the acoustical change, comply with the current Appendix C noise limits, and provides express authority for an "approved equivalent procedure" to show compliance with test procedures prescribed in Appendix C, including substitute measuring points for airplanes which have low noise level emissions. The EPA recommended regulation also proposes to amend the noise test procedure to require (1) during takeoff noise tests, that the airplane achieve an airspeed of V_2+10 knots (± 3 knots) or the maximum airspeed achievable with all engines operating, whichever is greater, as soon as practicable after liftoff, and that airplanes powered by two or more engines reach an altitude of at least 1000 feet above the airport elevation before any power or thrust cutback is made; and (2) during approach noise tests, that airplanes certificated with more than one flap setting show compliance at one flap position less than the maximum setting for which it is certificated. Further, the EPA proposes to amend the § 36.1(a) statement of aplicability by deleting the term "subsonic transport category large airplanes" and substituting for it the term "large propeller driven airplanes." The EPA states that it intends its recommended regulation to supplement and complement the proposed rules contained in FAA Notice 75-37 and the respective recommended regulations submitted to the FAA by the EPA under the Noise Control Act of 1972.

Interested persons are invited to participate in the making of the proposed rule by submitting such written data, views, or arguments as they may desire. Communications should identify the docket number and be submitted in duplicate to the Federal Aviation Administration, Office of the Chief Counsel, Attention: Rules Docket, AGC-24, 800 Independence Avenue, SW., Washington, D.C. 20591. Comments on the overall environmental aspects of the proposed rule are specifically invited. Information on the economic impact that might result because of the adoption of the proposed rule is also requested. All communications received by the FAA on or before February 28, 1977, will be considered by the Administrator before taking action on the proposed rule. The proposal contained in this notice may be changed in the light of the comments received. All comments will be available, both before and after the closing date for comments, in the FAA Rules Docket for examination by interested persons.

Any person may obtain a copy of this notice of proposed rule making (NPRM) by submitting a request to the Federal Aviation Administration, Office of Public Affairs, Attention: Public Information Center, APA-430, 800 Independence Avenue, SW., Washington, D.C. 20591, or by calling (202) 426-8058. Communications must identify the notice number of this NPRM. Persons interested in being placed on a mailing list for future NPRMs should also request a copy of Advisory Circular No. 11-2 which describes the application procedure.

A separate notice of hearing, published today in the "NOTICES" section of the FEDERAL REGISTER, announces that, pursuant to § 611(c) of the Federal Aviation Act of 1958, as amended, the FAA will conduct a public hearing in Washington, D.C., on December 14, 1976, to receive oral, as well as written, comments regarding the proposals contained in this notice of proposed rule making.

The following EPA opinions, conclusions, and proposed regulatory language are published verbatim as received from EPA by the FAA on October 1, 1976:

EPA PROPOSAL AS SUBMITTED TO FAA

In accordance with a recommendation made by the Administrator of the Environmental Protection Agency, the Federal Aviation Administration is considering an amendment to Appendix C of Part 36 of the Federal Aviation Regulations which would reduce the noise levels for turbojet powered airplanes and subsonic large propeller driven airplanes to levels as low as is consistent with safe technological capability.

Under the requirements of Section 7 (a) of the Noise Control Act of 1972 (Pub. L. 92-574, 86 Stat. 1234) the Administrator of the Environmental Protection Agency conducted a study of aircraft and airport noise and submitted a report thereon to the Congress. (Ref. 1, Report on Aircraft/Airport Noise, Senate Committee on Public Works, Serial No. 93-8, Aug. 1973).

Concurrent with the Aircraft/Airport Noise Study, the EPA also prepared a general document of criteria (Ref. 2) in conformance with Section 5(a)(1) of the Noise Control Act. That document reflects the scientific knowledge most useful in indicating the kind and extent of all identifiable effects on the public

health and welfare which may be expected from differing quantities of aircraft noise.

Subsequently, in March of 1974, in accordance with Section 5(a)(2) of the Noise Control Act, the EPA prepared a technical document (Ref. 3) containing the levels of environmental noise, the attainment and maintenance of which (in defined areas under various conditions) that are requisite to protect the public health and welfare with an adequate margin of safety. The key findings of that document may be summarized in pertinent part as follows:

(1) The preferred measure for cumulative noise exposure is Leq, the energy average A-weighted sound level integrated over a 24-hour period, or Day-Night Level, Ldn. Ldn is essentially the same as Leq, except that the sounds occurring during night hours (2200–0700) are weighted by an adjustment factor of 10 dB to account for increased annoyance of noise during night hours.

(2) An outdoor Ldn of 55 dB has been identified as requisite to protect public health and welfare with an adequate margin of safety from the effects of interference and annoyance on outdoor activities.

(3) An Leq (24) of 70 dB at the ear has been identified as requisite to protect public health and welfare with an adequate margin of safety from the effects of permanent hearing loss.

Under Section 611 of the Federal Aviation Act, as amended by the Noise Control Act of 1972, the Administrator of the EPA is required to submit to the Administrator of the FAA proposed regulations to provide such control and abatement of aircraft noise and sonic boom (including control and abatement of aircraft noise through the exercise of any of the FAA's regulatory authority over air commerce or transportation or over aircraft or airport operations) as the Administrator of the EPA determines is necessary to protect the public health and welfare. In accordance with the foregoing requirement, the EPA published in the FEDERAL REGISTER on February 19, 1974, (39 FR 6112) a "Notice of Public Comment Period" (Ref. 4) containing a synopsis of the proposed aircraft and airport rules it is considering to achieve a satisfactory level of aircraft noise control and abatement for the protection of the public health and welfare.

The proposed rules and the type of control which each rule would implement are as follows:

Flight procedures noise control. (1) Takeoff procedures. (2) Approach procedures. (3) Minimum altitudes.

Source noise control. (4) Retrofit/fleet noise level. (5) Supersonic Civil Aircraft noise. (6) Modification to Part 36 of the Federal Aviation Regulations. (7) Propeller driven small airplanes. (8) Short haul aircraft.

Airport operations noise control. (9) Airport goals, mechanisms and processes by which noise exposure of communities around airports can be limited to levels consistent with public health and welfare requirements.

This proposed rule, identified as Item (6), above, is one of the five rules whose purpose is to implement noise control at the source. As proposed herein, the rule would reduce the compliance noise levels and would require specific changes in applicability, takeoff, and approach test conditions as prescribed in Appendix C of Part 36 for subsonic turbojet engine powered airplanes and subsonic large propeller driven transport category airplanes (more than 12,500 pounds). The proposed rule would not apply to small propeller driven airplanes since those airplanes were covered in a recent amendment to Part 36 (Amt. 36–4) and a substitute proposal recommended by the EPA (NPRM 74–39, 40 FR 1061). However, in the event that Part 36 is made applicable to supersonic airplanes in accordance with the recommendations by the EPA (NPRM 75–15; 40 FR 14093), the amendments to Appendix C proposed herein would also be applicable to those airplanes. This extension of Part 36 to supersonic airplanes would be accomplished, as proposed in NPRM 75–15, by changing the words "subsonic turbojet airplanes" as they appear in the Applicability provisions of § 36.1(a) to read "supersonic and subsonic turbo jet powered airplanes".

The EPA believes that the achievement of the proposed levels is necessary in order to provide increased relief from aircraft noise and protection to the public health and welfare. The EPA also believes that the proposals, which would require time-phased incremental reductions in aircraft noise, are economically reasonable, technologically practicable, and appropriate for those airplanes.

A. REFERENCES

In the development of this proposed rule, the EPA conducted its own studies and evaluated several pertinent studies made by other Federal agencies and private contractors. Those studies are listed herein for the information of all interested persons and are available for examination at the FAA Rules Docket Office, GC–24, 800 Independence Ave., SW., Washington, D.C. 20590, or the EPA Office of Noise Control Programs, Crystal Mall No. 2, 1921 Jefferson Davis Highway, Arlington, Va. 20460. Copies of the studies prepared by Government Agencies are also for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C., 20402.

1. "Report on Aircraft/Airport Noise", Report of the Administrator of the Environmental Protection Agency in compliance with Public Law 92–574, Senate Committee on Public Works, Serial No. 93–8, August 1973.
2. "Public Health and Welfare Criteria for Noise", EPA Technical Document 550/9–73–002, 27 July 1973.
3. "Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety", EPA Technical Document 550/9–74–004, March 1974.
4. "Aircraft and Airport Noise Regulations", Notice of Public Comment Period, Federal Register (39 FR 6142), 19 February 1974.
5. "Noise Standards for Aircraft Type Certification (Modifications to FAR Part 36)", EPA Project Report, 2 August 1976.
6. "A Scheme for Modification of Annex 16 Noise Level Requirements", ICAO CAN/4–WP/39, United States, 20 January 1975. Also, "Subsonic Transport Category Large Airplanes and Subsonic Turbojet Powered Airplanes, Proposed Noise Reduction Stages and Acoustical Change Requirements", FAA NPRM 75–37, 40 FR 51476, 5 November 1975.
7. "Committee on Aircraft Noise: Fourth Meeting", ICAO CAN/4–WP/64, Report of Fouth Meeting Submitted to the Council, 13 February 1975.
8. "Civil Aviation Research and Development Policy Study", Joint DOT–NASA: Report, DOT–TST–10–4 and NASA SP–265; Supporting Papers, DOT–TST–10–5 and NASA SP–266; March 1971.
9. "Aircraft Noise Reduction Technology", A Report by the National Aeronautics and Space Administration to the Environmental Protection Agency for the Aircraft/Airport Noise Study, NASA TMX–68241, 30 March 1973.
10. H. H. Hubbard, and D. J. Maglieri, "A Brief Review of Air Transport Noise", Noise Control Engineering, November–December 1974.
11. "Aeronautical Propulsion Conference", Program Preprint, NASA Lewis Research Center, 13–14 May 1975.
12. "Noise Source Abatement Technology and Cost Analysis Including Retrofitting", Report of Task Group 4, EPA NTID 73.5, 27 July 1973.
13. J. O. Powers, "Future Noise Requirements for Commercial Aircraft", AIAA Paper No. 73–1290, AIAA/SAE 9th Propulsion Conference, Las Vegas, 5–7 November 1974.
14. A. L. McPike, "Toward Reducing the Impact of Aircraft Noise—A New Approach to Aircraft Noise Certification", Douglas Paper 6371, American Society of Civil Engineers, San Francisco, 24–26 March 1975.
15. V. L. Blumenthal, et. al., "A Positive Approach to the Problems of Aircraft Noise", AIAA Paper No. 73–1157, Montreal, 29–30 October 1973.
16. J. S. Gibson, "The Ultimate Noise Barrier—FAR Field Radiated Aerodynamic Noise, Inter-Noise '72 Proceedings, Washington, D.C., 4–6 October 1972.
17. J. S. Gibson, "Non-Engine Aerodynamic Noise Technology and Impact", Lockheed-Georgia Co. Information Brief IB7301, 6 April 1973.
18. "Predicted Noise Levels for Refanned Aircraft", Letter from W. H. Roudebush (NASA) to W. C. Sperry (EPA), 11 February 1975, Revised by Briefing Charts, 25 February 1975, and "Initial Report on DC–9 Refan Flight Test Program", W. H. Roudebush, 26 June 1975.
19. K. L. Abdalla and J. A. Yuska, "NASA Refan Program Status", Society of Automotive Engineers, Air Transportation Meeting, SAE 750592, Hartford, 6–8 May 1975.
20. "Noise and Performance Estimates", Letter from Ray E. Bates, (Douglas) to J. C. Schettino (EPA), 16 April 1975, and Letter from A. L. McPike (Douglas) to W. C. Sperry (EPA), 25 July 1975.
21. "Recommedations for Revised Annex 16 Scheme and Noise Level Requirement",

The Boeing Co., Draft 12 December 1974.
22. "Information on 727-200B and 7X7 Airplanes", The Boeing Co., Briefing to EPA on 14-15 May 1975, 5 June 1975, and Letter from R. E. Russell and H. W. Withington (Boeing) to W. C. Sperry (EPA), 4 June 1975, and 15 July 1975.
23. "BAC One-Eleven 700 Series", British Aircraft Corporation Brochure TSW 2508, August 1974, and "BAC-111-800 Series", Briefing Paper Received 20 May 1975.
24. "New Wide-Body Transport Plan Evolving", Aviation Week & Space Technology, 13 October 1975.
25. "DC-X-200 Melds DC-10, New Technology", Aviation Week & Space Technology, 20 October 1975.
26. "1977 NASA Authorization", Hearings before the Subcommittee on Aviation and Transportation R. & D. of the Committee on Science and Technology, U.S. House of Representatives, October 15, 16, November 3, 4, 5, and 10, 1975, No. 34, Volume II, Part 1.
27. G. D. Brewer, "Liquid Hydrogen—A Logical Choice to Fuel Future Commercial Airplanes", Lockheed California, Co., ICAO Bulletin, February 1976.
28. "CFM 56 Briefings", CFM International, S.A., May 1976.
29. "Canadair Sees Big Lear Star 600 Market", Aviation Week and Space Technology, 26 July 1976.

B. Regulatory Background

To date, the FAA has adopted the following source noise control regulations which have a significant influence on aircraft noise.

(1) Part 36, "Noise Standards: Aircraft Type Certification", which became effective on December 1, 1969, (34 FR 18355), prescribed noise measurement, noise evaluation, and noise levels for the type certification, and changes to type certificates, for subsonic transport category airplanes, and for subsonic turbojet powered airplanes regardless of category. There is no similar set of standards for supersonic airplanes although the preamble to Part 36 when that Part was adopted, stated that additional rule making would be proposed at the earliest possible date for the noise certification of supersonic airplanes. However, it should be noted that the EPA has proposed such a rule for supersonic airplanes which was published in the Federal Register inviting public comments (Notice 75-15, 40 FR 14093). In addition, public hearings were later conducted by the FAA with respect to the proposals contained in that notice. To date no final rulemaking has been adopted in regard to EPA's proposal.

(2) Part 36, "Noise Standards: Aircraft Type Certification" was amended on October 26, 1973, (Amdt. 36-2, 38 FR 29569) to require new production turbojet and transport category subsonic airplanes to comply with the noise requirements of Part 36, regardless of the date of the type certification for those airplanes. That amendment changed the title of Part 36 to "Noise Standards: Aircraft Type and Airworthiness Certification" to conform to the substance of Amendment 36-2, and established the following dates by which new production airplanes of older type designs must comply with the noise requirements of Part 36.

(a) 1 December 1973 for airplanes with maximum weights greater than 75,000 pounds, except for airplanes that are powered by Pratt and Whitney JT3D series engines;

(b) 31 December 1974 for airplanes with maximum weights greater than 75,000 pounds which are powered by Pratt and Whitney JT3D series engines; and

(c) 31 December 1974 for airplanes with maximum weights of 75,000 pounds and less.

(3) Part 36 was then amended, effective 20 January 1975 (Amt. 36-3, 39 FR 43830) to require an applicant for an acoustical change approval to show that modifications of certain turbojet or transport category airplanes will not increase the takeoff or sideline noise levels of those airplanes. Under that amendment the following changes were made to the acoustical change provision of Part 36 which significantly decreased community noise impact by preventing methods of circumventing that provision:

(a) Thrust reduction is not permitted;

(b) Test airspeed is more precisely specified, and

(c) The quietest approved configuration for the highest approved takeoff weight must be used.

(4) Effective 7 February 1975 (Amt. 36-4, 40 FR 1029), the FAA extended the acoustical change approval provisions, included them in a new § 36.7, and introduced new noise standards for normal, utility, acrobatic, transport, and restricted category propeller driven small airplanes (12,500 pounds or less maximum weight). However, it should be noted that the EPA objected to Amendment 36-4 because it believed it was too lenient and proposed a rule which was significantly more stringent (Notice 74-39, 40 FR 1061). The EPA's substitute proposal was published in the Federal Register and public comments were invited to that proposal. In addition, a public hearing was later conducted by the FAA with respect to the proposals contained in that notice. To date no final rulemaking has been adopted in regard to EPA's substitute proposal.

(5) An advance notice of proposed rulemaking was published on August 6, 1970 (ANPRM 70-33, 35 FR 12555) proposing noise requirements for the type certification of civil supersonic airplanes. In addition, pursuant to section 611(c)(1) of the Federal Aviation Act of 1958, the EPA recommended the adoption of an amendment to Part 36 which would require certain civil supersonic airplanes to comply with the noise level requirements of Appendix C of Part 36 (NPRM 75-15; 40 FR 14093).

Although Part 36, which was adopted in December 1969, was the first type certification regulation for aircraft noise prescribed by any country, the development of the basic concepts inherent in that Part represents the experience of the U.S. and foreign governments as well as the U.S. and foreign private industry. As a result, the Council of ICAO, in April 1971, adopted as Annex 16 to the Convention of International Civil Aviation, aircraft noise rules, containing standards and recommended practices that are essentially the same as those in Part 36, but slightly more lenient.

Part 36 provides the requirements for the issue of a type certificate signifying that an aircraft type design has been demonstrated to conform to FAA standards on noise. Other parts of the Federal Aviation Regulations pertain exclusively to airworthiness. Each aircraft requires an airworthiness certificate which signifies that the specific aircraft has been manufactured in accordance with its FAA certified type design (including Part 36) and has subsequently been maintained according to regulations.

The contents of Part 36, in addition to preamble, applicability, effective dates, and enforcement, include four technical appendixes as follows:

(1) Appendix A contains requirements for acquiring, processing, correcting, reducing, and reporting of data relating to noise, meteorology, and aircraft performance and flight paths,

(2) Appendix B contains requirements for computing the noise evaluation measure denoted as effective perceived noise level (EPNL) in units of EPNdB which includes the effects of the flyover noise duration and the maximum tone,

(3) Appendix C contains requirements for the noise measuring points, compliance noise levels, and the takeoff and approach flight test conditions, and

(4) Appendix F contains requirements pertaining exclusively to propeller driven small airplanes (12,500 lb. maximum weight) and is independent of Appendixes A, B, and C.

The original purposes of Part 36 were:

(1) to provide requirements which would influence the design of aircraft to include implementation of source noise control technology to the maximum extent feasible,

(2) to obtain meaningful noise levels for specific types of aircraft which would be useful in predicting the noise impact in airport neighborhood communities, and

(3) to set standards and recommended practices for the acquisition and reduction of repeatable and reproducible data.

C. Proposed Amendments

Except for the amendment to the applicability provisions of § 36.1(a)(1), the amendments recommended by the EPA in the following paragraphs of this notice of proposed rulemaking are directed to the noise measurements, levels, and tests in Appendix C of Part 36. Further recommended rule changes affecting the standards contained in Appendices A and B of Part 36 may be submitted by the EPA in a separate document. Upon receipt of those recommendations by the FAA they will be published in the Federal Register as a separate notice of proposed rulemaking in accordance with Section 611(c) of the Act.

The amendment to § 36.1(a)(1) referred to above does not involve a substantive change. In view of the recent amendment (effective 7 February 1975) which expressly refers to small propeller driven airplanes (Amt. 36–4; 40 FR 1029), other propeller driven airplanes covered herein are referred to as "large propeller driven airplanes". The use of this term instead of "transport category large airplanes", as used in Amendment 36–4, should avoid any misunderstanding as to which propeller driven airplanes are intended to be covered by this proposal.

Included in the following paragraphs are recommendations pertaining to "acoustical changes" and "major acoustical changes". As defined in Part 36, any voluntary change in the type design of a transport category or turbojet engine-powered airplane that may increase the noise levels created by that airplane is an acoustical change. Generally, the most important acoustical changes are related to airplane growth. A new airplane design is usually grown over its lifetime by increasing its capacity, range, or both. The recommendations on acoustical change approvals included herein would apply noise limits to airplane weight increases as proposed by the FAA.

The recommendations herein also include a definition for a major acoustical change which makes a distinction between changes in type designs that are a result of normal growth of older technology equipment and those that are the result of the applications of current technology equipment. The purpose is to restrict the production of new airplanes incorporating current technology equipment but which do not include the noise control technology capability of that equipment.

C1 NOISE MEASUREMENT AND EVALUATION

Section C36.1 of Appendix C, which specifies the noise measuring points and the airplane takeoff and approach test conditions to achieve the noise levels of that Appendix, states in part that compliance with Appendix C "must be shown with noise levels measured and evaluated as prescribed, respectively, by Appendix A and Appendix B of this Part (Part 36), or under approved equivalent procedures."

§ 36.101 and § 36.102 contain language which expressly authorizes the use of an "approved equivalent procedure" for the noise measurements and evaluations prescribed in Appendices A and B, respectively. However, it is to be noted that Part 36 does not contain a similar provision containing language which expressly authorizes the use of an "approved equivalent procedure" for the test procedures (including the location of measuring points and takeoff and approach test conditions) prescribed in Appendix C. In the absence of such an express authorization for Appendix C, it is not clear whether the above quoted provision of § C36.1 was intended to authorize the use of an "approved equivalent procedure" to show compliance with the test procedures in Appendix C, as well as Appendices A and B.

The EPA believes that flexibility should also be provided for compliance with the procedures prescribed in Appendix C. To make this position unmistakeably clear it is proposed to add a sentence at the end of § C36.1 expressly stating that approved equivalent procedures may also be permitted for compliance with the procedures in Appendix C.

C2 NOISE MEASURING POINTS

Section C36.3 of Appendix C requires noise levels prescribed in that Appendix to be achieved at specified measuring points for (a) takeoff, (b) approach, and (c) sideline.

(a) *Takeoff.* Experience derived from FAA noise certification tests since 1969 has shown that a measuring point located at 3.5 nautical miles from the start of the takeoff roll as specified in § C36.3(a) is satisfactory for determining noise levels which are produced by relatively noisy airplanes. However, for airplanes which have substantial applications of noise control technology, or have relatively large takeoff climb angles, or both, the noise signal received at the 3.5 nautical mile measuring point may be masked by normal background noise at the test site. To insure consistent results, the EPA believes that standardized, alternate takeoff procedures should be provided in Appendix C for those airplanes whose noise measured at the prescribed measuring point would not be reliable because signal to noise ratios (S/N) are too small.

The EPA believes that the adoption of one of two alternate procedures as a standardized procedure would provide a solution to the problems now experienced. The first procedure would include in § C36.3(a) an alternate takeoff noise measuring point located nearer to brake release than 3.5 nautical miles. Under this procedure the microphone would be nearer to the airplane flight path thus increasing the signal to noise ratio. The second procedure would retain the standard reference distance of 3.5 nautical miles from brake release, but change the flight procedure as specified in proposed § C36.8 so that the airplane flight path would be horizontal and nearer to the microphone. Although both procedures have merit, the EPA has recommended the second one since it has a precedent in the noise measuring procedures used for propeller driven small airplanes.

Under Amendment 36–4, referred to in the regulatory background for this proposal, small propeller driven airplanes are required to demonstrate compliance with the prescribed noise levels of Part 36 by means of horizontal flights at a height of 1,000 feet over a noise measuring station. However, the noise levels determined by means of the horizontal flyover must be corrected for both climb performance and speed. The formula used for that correction yields a level in decibels which, when added algebraically to the measured noise level of the horizontal flyover, approximates the noise level at a specified reference distance from the start of the takeoff roll. The EPA believes that it is reasonable to extend that horizontal flight procedure to all airplanes which cannot be measured reliably for takeoff noise at the 3.5 nautical miles measuring point.

Another reason for the EPA's preference for the horizontal flyover procedure, where appropriate, is that it is convenient. The standard takeoff noise test requires an applicant to execute the normal takeoff and climbout procedure for the airplane being tested with the microphone at 3.5 nm from the takeoff roll. In most cases the S/N can be judged satisfactorily during that test. If the S/N is not adequate, however, the proposed alternate flyover procedure would permit the applicant to conduct the remainder of the tests (required to demonstrate compliance with that airplane) by circling and flying horizontally over any approved microphone without an undue delay or added expense.

In principal, the noise levels at an alternate takeoff measuring point could be corrected to approximate the levels at the 3.5 mm reference distance. However, in practice the results for some applications would be less reliable than those derived from the horizontal flight procedure. The reason is that airplanes generally are not stabilized with respect to configuration, speed, and climb angle until they have reached a height above airport of at least 400 feet and that it is not considered safe to execute thrust cutback for noise abatement below about 700 feet. Consequently, the use of an alternate measuring point, located nearer to the climb path than the 3.5 mm point, might result in noise levels that have been significantly influenced by airplane climb performance below heights of 400 and 700 ft, contrary to the intent of the takeoff test procedure.

Based upon the foregoing reasons, the EPA recommends, as proposed herein, that Appendix C be amended by adding a new § C36.8 to include the second alternate takeoff test procedure as described above in those cases in which the signal to noise ratio is inadequate. However, as distinguished from the correction formula specified in Amendment 36–4 for small propeller driven airplanes, the correction formula proposed herein would be based upon both climb performance and speed.

In support of that correction formula the EPA points out that the horizontal flight noise certification test, by itself, will not provide sufficient information to make a judgment on the relationship between airplane climb performance and noise exposure on the ground. Two airplanes with the same engines would be expected to produce about the same noise level over the measuring station at a height of 1,000 feet, even though the total weight of one airplane might be substantially greater than the other. However, the higher performance airplane (greater thrust/weight ratio) would be expected to have the capability to produce smaller contour areas and, hence, less community noise impact.

The foregoing deficiency in the horizontal flyover procedure can be remedied by a correction formula with factors relating to airplane performance (both climb and speed) and the reference distance (3.5 nautical miles or 21,266 feet). The development of the correction formula for climb performance, applicable to turbojet powered airplanes, is given in Reference 5 and expressed as:

$$C=60-20\log[(21266-D35)\sin\alpha+35]$$

where:

$$\alpha=\arcsin[(R/C)/(VY)].$$

The climb correction C is the value in decibels which, when added algebraically to the measured noise level at 1,000 feet (horizontal flyover), approximates the noise level at the 3.5 nautical miles (21,266 ft) reference distance. The climb angle α in degrees is dependent upon the rate of climb (R/C) in feet per minute corresponding to the airplane climb speed (VY) in feet per minute equivalent to V2+10 knots, or greater if approved. The takeoff distance D35 in feet is the horizontal projection from start of takeoff roll to a point on the runway at which the airplane is at a height of 35 feet above the runway. The climb correction formula is based upon the assumption that the angle of climb is relatively small which is appropriate for all Part 36 airplanes (the error is less than 0.5 dB at 12 degrees).

The climb correction C adjusts the measured noise level under test conditions to the expected noise level at the reference distance (3.5 nm) from start-of-roll. In addition, under test conditions (horizontal flight, at 1,000 feet height above the test site with maximum thrust) the aircraft can be expected to fly over the test site at a speed greater than the takeoff climb speed. Therefore, the duration of the sound, a factor to be considered in human subjective reaction to noise (and included in EPNL), would be less under the horizontal flight path than under the climb path. In order to make a proper assessment of the noise measured under the simplified test conditions, the noise level corrected for climb performance must be further corrected to account for the change in speed which results in a change in noise duration. The speed correction formula appropriate for this purpose is:

$$S=10\log(VH/VY)$$

Where: VH is the speed, averaged for all test flights, at the aircraft position for which the tone corrected perceived noise level is maximum with the aircraft operating at takeoff thrust and in horizontal flight 1,000 feet over the measuring point. S is the speed correction in decibels to be added algebraically to the measured noise level. The speed correction S would correct the measured noise level to the EPNDB values that would result from the actual climb speed.

In summary, the resulting performance correction, expressed in dB, which should be added algebraically to the noise levels, expressed in EPNdB, measured 1000 feet below a turbojet engine powered airplane in horizontal flight at maximum thrust is:

$$P=C+S\ \text{(For turbojet airplanes)}=60-20\log[(21266-D35)\sin\alpha+35]+10\log(VH/VY)$$

For propeller driven large airplanes, the only change in the performance correaction P is the takeoff distance included in the climb correction C as follows:

$$P=C+S\ \text{(For propeller driven large airplanes)}=60-20\log[(21266-D50)\sin\alpha+50]+10\log(VH/VY)$$

The takeoff distance D50 in feet is the horizontal projection from brake release to a point on the runway at which the airplane is a height of 50 feet above the runway. All other symbols are as defined previously.

(b) *Approach.* Experience, derived from FAA noise certification tests since 1969 has shown that the measuring point for approach (1 nautical mile from threshold) as described in § C36.3(b) is satisfactory for determining airplane noise levels that result from stabilized approach operations conducted along a single segment constant glide angle. However, the EPA believes that if other approach procedures, such as the two-segment approach recommended by that agency in a separate proposal for the reduction of approach noise, are standardized, then an additional measuring point (or points) farther from the runway should be specified for approach noise certification testing.

(c) *Sideline.* Experience, derived from FAA noise certification tests since 1969 has also shown that the sideline measuring point, on a line parallel to and 0.25 nautical miles from the extended centerline of the runway, is satisfactory for all turbojet engine powered airplanes regardless of the number of engines. For uniformity, the EPA recommends that the alternative sideline measuring point at a distance of 0.35 nautical miles permitted for airplanes powered by more than three turbojet engines, be eliminated from § C36.3(c).

C3 NOISE LEVELS

The objective of Part 36 is to provide requirements which would influence the design of aircraft to include implementation of source noise control technology to the maximum extent feasible. Source noise control consists of the application of basic design principles or special hardware to the aircraft engine/airframe combination for the purpose of minimizing the generation and radiation of noise from that aircraft. The technology of source noise control is time-dependent in the sense that it is based upon the results of past, present, and future programs of research, development, and demonstration (RD&D) which may be classified as current, available, and future noise control technology.

As used in this document, current technology means "shelf item" hardware and commonly known state of the art techniques and procedures which have been used effectively by most manufacturers for many applications.

Available technology means "shelf item" hardware and commonly known state of the art techniques and procedures which have been used effectively by some manufacturers for some applications. The term also includes the results of RD&D which have not been put into practice but are available for implementation. Some performance testing may still be necessary, but the technology has been certificated for airworthiness or, by adequate ground and/or flight testing, determined to be capable of being certificated.

Future technology means the results of RD&D programs now in progress which have not been verified, but the results to date indicate high potential to a reasonable degree of confidence. The term includes present RD&D programs which are being conducted with sufficient resources of manpower, funding, and time to carry the program to conclusion. Definitive results are expected in the near future for acoustical and operational performance, economics, and flight safety. The nature of the expectations is positive, because predictions of nonviable results would have been cause for earlier termination of the RD&D programs.

The application of the foregoing source noise control technology may be directed to either existing or newly produced aircraft. In the case of existing aircraft, source control is applied by retrofitting acoustical treatment to the engines/nacelles during a non-operative or shutdown period. As used here, acoustical treatment means any hardware or mechanical device, applied either singly or combined to the inlet and primary and secondary exhausts, that either will absorb sound or otherwise effect a noise reduction at the Part 36 measurement points. In the case of new production aircraft, source control may be applied during the manufacturing process to either new type design aircraft, or older type design aircraft. In the case of acoustical treatment, the source control measures available for existing or newly produced aircraft of the same type design are essentially the same since the treatment that is effective for one will be equally effective for the other. However, the most practical use of technology to achieve maximum noise control is the inclusion of such technology in the design and development of new aircraft types. Subsequent modifications of the aircraft design such as retrofit hardware are always the less efficient, but often necessary, use of technology for the source control of aircraft noise.

In order to achieve the lowest practicable noise levels for all aircraft, regardless of the date of type certification, the EPA believes that regulations for the source control of aircraft noise should be constructed to fully represent the use of the three time-dependent technology options (current, available, and future) for the following four classes of aircraft:

(1) Existing Aircraft,

(2) New Production Aircraft of Older Type Design,

(3) New Production Aircraft with Acoustical Changes to Older Type Design, and

(4) New Production Aircraft of New Type Design.

Although the compliance noise level of § C36.5 are applicable to all four of the above classes of aircraft, only current technology prior to 1969 is represented in that Appendix. Therefore, the EPA has recommended, as proposed herein, that § C36.5 be amended to include noise levels that are substantially lower than those of Appendix C. Moreover, to encourage the implementation of noise control technology to the maximum extent feasible the EPA also recommends that Part 36 should be reviewed every 5 years or less and updated where necessary to reflect the technology options that are practicable and appropriate for the aircraft types at that time. The comments of all interested persons are invited in regard to the need and desirability of such a periodic quinquennial review.

Noise certification tests since 1969 show that current technology airplanes are capable of achieving substantially lower noise levels than those required by Appendix C. The data given in Reference 5 illustrates the wide range of noise levels produced by airplanes in the present fleet of two or more engine airplanes. It is to be noted that the range for all of the airplanes given in that Reference is over 40 decibels, varying from a low of about 78 EPNdB at takeoff to nearly 119 EPNdB at approach. It should also be noted that although many of the noise levels are above the Part 36 noise level curves, most are below. As a result, in 1975, the FAA in a U.S. Working Paper and subsequently in NPRM 75–37 (Ref. 6) recommended that lower compliance noise levels be adopted. However, although the Committee on Aircraft Noise, ICAO CAN/4 (Ref. 7), also recommended that the ICAO Council adopt lower compliance noise levels, they are generally less stringent than those recommended by the FAA. The noise levels recommended by the FAA represent reductions from the Appendix C levels that are dependent upon airplane weight and number of engines within the following ranges:

(1) Sideline (5 to 9 dB),
(2) Takeoff (1 to 10 dB), and
(3) Approach (3 to 4 dB).

As distinguished from the FAA recommendations, the recommendations of the ICAO Committee on Aircraft Noise are independent of the number of engines and agree with the FAA recommended levels in only two cases (sideline four engines and approach). Thus, the levels recommended by the ICAO Committee on Noise as amendments to Annex 16 represent reductions from the Appendix C levels that are dependent upon airplane weight within the following ranges:

(1) Sideline (5 to 6 dB),
(2) Takeoff (1 to 10 dB), and
(3) Approach (3 to 4 dB).

The formulas for the compliance noise level curves representing Appendix C, the FAA, and the ICAO are shown in the attached Table 1. The table shows that the slopes of the curves for Appendix C and the ICAO are identical for all three measuring points. However, the slopes of the curves for the FAA agree with the Appendix C and the ICAO curves only for sideline and approach. In addition, the slope of the curve showing the FAA recommendation for takeoff is lower (4- versus 5 dB per halving of weight) than that for Appendix C and the ICAO recommendation.

(a) *Current and Available Technology.* The attached Figures 1 (a), (b), and (c) show the airplane noise levels listed in the attached Table 2 compared with the noise level curves for Appendix C, identified as 69 FAR 36. The 17 airplanes listed were chosen as a control group on the basis that they all meet the requirements of Appendix C. As such, they are designated "current technology" airplanes. In addition, those airplanes were selected, where feasible, to include two models of each type, one at the low and one at the high end of their weight range in order to show the influence of growth (increase in weight or range) for that particular model. Models of pre-1969 technology airplanes which can now meet the requirements of Appendix C by means of retrofit applications of Quiet Nacelles, were not included in the control group since those airplanes are not representative of current technology airplanes in the sense of original design, although in some cases they are newly produced and may continue to be produced for many years.

The three curves shown in the attached Figure 1 represent the Appendix C requirements, the least squares means of the 17 airplane sample, and the mean less three decibels. The upper curves, representing the existing Appendix C requirements, cannot be met by pre-1969 technology airplanes (except by retrofit). The middle curves (mean curves) show that the state of the art includes efficient, high performance airplanes such as the B747, DC–10, L–1011, A–300, Cessna 500, Falcon 10, Learjet 35, and Corvette, whose noise levels could comply with the mean levels.

Both the FAA and ICAO recommendations have merit in the sense that the compliance noise levels for new airplanes would be significantly lowered from those of Appendix C. The EPA, therefore, has no objection to either of those lower limits (or some compromise of the two) provided they are applicable only to new type design airplanes up to 1980 with more stringent requirements, as proposed herein, applicable to available and future technology airplanes.

Furthermore, the EPA believes that the compliance noise levels representing current noise control technology to be promulgated by the FAA (whether as proposed in NPRM 75–37 or in the ICAO CAN/4 report or some compromise of the two) should be applicable to new production aircraft with major acoustical changes to older type designs as well as to those of new type designs. As defined in § 21.93, a major change is any change that is not a minor change as defined therein. In addition, it includes an acoustical change where applicable. As proposed here, a major acoustical change in a type design consists of the application of current noise control technology equipment to older type design airplanes. It would not include modifications such as "Quiet Nacelles", uprated or growth versions of original equipment engines, and existing type engines different from the original equipment engines.

The major acoustical change provision makes a distinction between changes in type designs that are a result of normal growth of older technology equipment and those that are the result of the application of current technology equipment. The purpose of that provision would be to restrict the production of new airplanes incorporating current technology equipment but which do not include the noise control capability of that equipment. A pertinent example would be a new airplane, consisting of an older type design airframe, utilizing a derivative refan engine (developed by NASA primarily for the purpose of noise control) for increased performance benefits at a sacrifice of some or all of the noise control benefits that are possible with the use of the engine.

It is reasonable to expect that a newly produced airframe/engine combination should include all of the noise control technology benefits capable for that combination, particularly if the development costs for the engine were funded by the Government for that purpose. In other words, the NASA Refan Engine (as well as a new type design engine) should not be considered a normal growth engine just because it is installed on an older type design airframe. The EPA, however, does not propose that the major acoustical change provision be applicable to retrofit of existing airplanes but only to new production airplanes.

Table 3 lists eleven study airplanes which represent major acoustical changes to existing airplanes. Figures 4 (a), (b), and (c) show the predicted noise levels for these airplanes. Those Figures also show the mean curve for the 17-airplane control group, representing current technology. The levels of those eleven airplanes are given in References 18–20. The EPA believes that this information supports its recommendation that the compliance noise levels to be promulgated by the FAA for current technology airplanes should also be met for major acoustical change airplanes.

In regard to available noise control technology, the EPA believes that the capability exists for airplanes whose type certificates are applied for after 1979 to comply with substantially more stringent requirements. Therefore, the EPA has recommended, as proposed herein, that § C36.5 be amended to include noise levels defined by the mean of the 17 air-

plane sample less three decibels (mean—3db). The effective date would be 1 January 1980.

The rationale for this proposal is based upon the fact that eight airplanes of the seventeen airplane sample could comply with the mean, only one of which would require the use of the tradeoff provision of § C36.5(b). Seven airplanes, therefore, have noise levels at all three measuring points within three decibels of the proposed requirement (mean—3db). Furthermore, a total of ten airplanes of the seventeen airplane sample could comply individually with the mean—3db at the sideline, takeoff, and approach measuring points. Three of those airplanes could comply collectively at all three measuring points. Therefore it is not unreasonable to assume that as a minimum, technology is available to "fine tune", the noise control of those existing airplanes for less than three decibels more noise reduction by the use of such techniques as sound absorption material (SAM), thrust cutback, increased thrust/weight ratios, improved lift/draft ratios, reduced approach flaps, etc. Consequently, with available noise control technology capability, new type design airplanes, that is, airplanes that are not constrained to existing type airframes or engines, should be ably to comply by 1980 with noise levels at least three decibels lower than existing airplanes such as the eight previously identified (B–747, DC–10, etc).

(b) *Future Technology.* Substantial achievements in noise reduction, as manifested by the mean curves, have encouraged predictions that aircraft noise at the Part 36 measuring points can be reduced ten decibels or more (e.g., the CARD Study, Ref. 8). Those achievements were obtained primarily as a result of research, development, and demonstration (RD&D) initiated before the promulgation of Part 36. Noise control RD&D, funded both by Government and industry, show that further achievements will be practicable and are relatively near at hand. The EPA, therefore, recommends that these achievements should be considered for inclusion in the designs for new aircraft types produced some time in the future, probably not before 1985.

The National Aeronautics and Space Administration (NASA), is the single largest contributor to aircraft noise control. A comprehensive report on the NASA noise reduction technology programs and plans, as of March 17, 1973, was made by that Agency for the EPA in connection with the Aircraft/Airport noise study (Ref. 9). Although that report has not been revised since that date, the material is valid and the NASA programs and plans discussed therein should have a strong influence on fuutre aircraft design. The brief review of information on air transport noise control (Ref. 10) and future needs and research trends (Ref. 11), partially updates the earlier NASA report.

The noise reduction accomplishments to date and the extensive programs in progress do indeed hold promise for further substantial gains. Nevertheless, there is a limit, or floor, beyond which it may be impractical to proceed. Consequently, sources of noise such as jet exhaust stream, engine core and flow surface interactions have been identified as potential noise floors which may be relatively near at hand. (Ref. 9–17), barring any technological breakthrough.

Flow surface interatcion noise is produced by the interaction of flows with solid surfaces of the aircraft, and can result from propulsive and nonpropulsive sources. An example of a propulsive source is a powered-life aircraft where the interaction of the jet engines exhaust with the wing and flap surfaces can be significant noise sources. Nonpropulsive noise is produced by aerodynamic boundary layers or the turbulence produced by air passing over and around the airframe and its various components, such as flaps, landing gear, landing gear openings and doors, and other protuberances or cavities that tend to disrupt smooth flow.

It is becoming more apparent that nonpropulsive noise (also referred to as airframe, aerodynamic, or self noise) must be considered in the design of future aircraft if significant further noise reduction is to be achieved. Of the three measuring points specified in Appendix C, that noise would be most noticeable at approach because engine power and distance to the microphone are least. Some members of the industry have expressed the opinion that aircraft noise is approaching the level which would limit the feasibility of further engine noise control. Therefore, they contend that new and expensive engine noise control programs should not be proposed if airframe noise (the aerodynamic noise floor) is the limiting factor.

Figure 2 shows the estimated range of nonpropulsive noise at the approach measuring point for typical airplanes. That Figure also shows the mean minus 3 dB curve, representing available noise control technology. The range is constructed from the ranges given in References 10 and 15. It is interesting to note that the upper limit of the range is less than one decibel below the mean—3 dB noise level curve and has the same slope. Reference 17 reports the results of an analysis of about ten commercial and military airplanes which substantiates the validity of that range of levels, including the slope. The conclusion of Reference 17 is that the trend of the data is a line which has a slightly greater slope than the 69 FAR 36 minus 10 dB curve. Such a line would lie within the range shown whose limits have a slope equal to 2.107 dB per doubling of weight which is slightly greater than the 2.000 dB per doubling of weight of the 69 FAR 36 curve.

It is apparent from Figure 2 that the noise levels for approach, defined by the mean—3 dB curve, have nearly reached the airframe noise floor predicted at this time. It appears that further reductions in the noise levels for approach are contingent upon the development of technology for reducing the nonpropulsive noise sources.

The EPA believes that the development of practicable noise levels representing future noise control technology are dependent upon determining the limiting levels resulting from the three noise sources relating to jet exhaust stream, engine core, or airframe. It appears at this time that airframe noise may be the limiting source in that noise levels lower than the self noise generated by a reasonably clean airframe cannot be achieved by demonstrated technology. Although it is possible that the levels of jet stream or core engine noise may bottom out before airframe noise, the technology capability for substantially lowering the levels of the jet and core sources appears to be more promising than for the airframe source (Ref. 5).

Specific incremental levels representing the differences between a clean wing and a reasonably clean airframe cannot be established with absolute certainty at this time. However, the EPA believes that the following incremental levels, adjusted to yield round numbers at the maximum aircraft weight limits, are reasonable estimates based upon available data (Ref. 5 and 16):

(1) Sideline, 7.5 dB, (2) Takeoff, 7:5 dB, and (3) Approach, 5.5 dB.

The increment for approach given in (3) above is in accordance with the recommendation contained in Reference 16. The increments for sideline and takoff have been assumed to be equivalent because the airplane speeds and configuration should be about the same. A two decibel difference between the increments for sideline and takeoff as distinguished from that for approach appears reasonable considering the differences in speed and configuration.

Figures 3(a), (b), and (c) show the EPA proposed compliance noise level requirements representing available and future noise control technology derived from the mean—3 db of the 17 airplane sample, and the foregoing analysis for future technology. The two curves are further identified as 80 FAR 36 and 85 FAR 36 to indicate representative time periods for implementation. The future technology curves for sideline and approach require little explanation; they are the estimated levels for a clean wing adjusted linearly upwards by 7.5 and 5.5 decibels, respectively. The curve for takeoff requires a more complex procedure because the modifications to the clean wing include a slope adjustment as well as a linear level adjustment. The development for those future technology curves is discussed in greater detail in the EPA Project Report upon which this proposal is based (Ref. 5).

The Civil Aviation Research and Development (CARD) Policy Study (Ref. 8) conducted a comprehensive review of policies affecting civil aviation. The CARD Study recommended, based upon their assessment of technical capability, that, by 1981, noise from all new airplanes should be reduced at least 10 decibles below the Appendix C levels and possibly as much as 22 decibels, depending upon the measuring point and the

airplane weight. The CARD Study goals, established in 1971 for ten years after that date, can nearly be achieved by the available levels and can be achieved completely by the future levels.

It must be emphasized that the future technology noise compliance curves shown in Figure 3 represent airframe noise floors predicted at this time. The predictions are, admittedly, rough and it is conceivable that the results of research, development and demonstration (RD&D) within the next ten years could lead to even lower noise levels. For example, it was assumed, based upon rather simple predictions, that the ultimate lower limit would be the noise levels produced by an aerodynamically clean wing. In addition, a further assumption was made that noise levels of practical airframes could approach those of clean wings by only 7.5 dB for sideline and takeoff and 5.5 dB for approach. Therefore, RD&D should be conducted with objectives which include the determination of airframe noise levels for clean airframes and the development of design data for practical airframes which would narrow the airframe noise gap between clean and practically clean airframes.

(c) *Predicted Noise Levels for New Type Airplanes.* Figures 5(a), (b), and (c) show the predicted noise levels for the new type design airplanes listed in Tables 4(a) and (b) compared with the mean curves and the two sets of proposed compliance noise level curves representing available and future noise control technology (Refs. 22 through 29). The EPA believes that this information supports its recommendations for the compliance levels proposed in § 36.5(a) that must be met for new type airplanes.

The comparisons shown in those Figures represent predicted noise levels of new types of airplanes and two of the curves represent compliance noise levels proposed in § C36.5(a) that must be met after certain dates of application. First, under § C36.5(a)(2), airplanes whose type certificates are applied for on or after 1 January 1980 and before 1985, would be required to meet 80 FAR 36. Second, under § C36.5(a)(3), airplanes whose type certificates are applied for on or after 1 January 1985 would be required to meet 85 FAR 36 which is the estimated practicable noise floor as perceived at this time.

Comparison of the sideline noise levels of the airplanes with the levels represented by the curves, it is seen that sixteen airplanes comply with the mean, eight comply with 80 FAR 36, and three with 85 FAR 36. Similarly for takeoff; twenty airplanes comply with the mean, eleven with 80 FAR 36, and seven with 85 FAR 36. And for approach; ten airplanes comply with the mean, seven with 80 FAR 36, and three with 85 FAR 36. Considering all three measuring points, and exercising the 3/2 decibels tradeoff provision, nine airplanes can comply with the mean, five with 80 FAR 36, and three with 85 FAR 36.

It is seen from Figure 5, that a few of the airplanes (Nos. 7, 18, 26, 27, 28, 29, 30 and 33) are shown with levels below the predicted noise floor for one or more of the noise measuring points. This peculiarity, however, does not necessarily contradict the choice of levels for the airframe noise floor because the sources of the data may have based their noise level predictions on estimations of the capability for noise control by means of aircraft engine design technology without consideration given to whether the airframe noise floor has been reached or exceeded. In other words, these sources may be predicting that the propulsive noise floor will not "bottom out" below the nonpropulsive noise floor. It should be pointed out, however, that airplane No. 8 is similar to the Airbus (A 300 B), listed as airplane No. 7 in Table 2, which has been certificated for noise in conformance with Annex 16. The takeoff noise level for the Airbus would lie approximately on the curve representing future noise control technology. It may be that the Airbus has indeed reached the airframe noise floor for takeoff operations.

(d) *Summary of Proposed Noise Levels* Based upon the foregoing analysis on noise levels, the EPA recommends that § C36.5 be amended to include the following compliance noise levels:

(1) *Pre-1969 Technology Airplanes.* The compliance noise levels defined as 69 FAR 36, which are existing requirements applicable to newly produced airplanes of older type designs, are adequate, except for some acoustical changes, and need not be amended.

(2) *Current Technology Airplanes.* Compliance noise levels, applicable to new type design airplanes, shall be as recommended by the FAA in NPRM 75–37 or by ICAO in the CAN/4 report or some compromise of the two.

(3) *Available Technology Airplanes.* Compliance noise levels, applicable to new type design airplanes for which an application for a type certification is made on or after 1 January 1980, shall be represented by the set of curves in Figures 3 identified as "available" or 80 FAR 36.

4. *Future Technology Airplanes.* Compliance noise levels, applicable to new type design airplanes for which an application for a type certificate is made on or after 1 January 1985, shall be represented by the set of curves in Figures 3 identified as "future" or "85 FAR 36". Although the 85 FAR 36 levels are proposed to be effective eight to nine years in the future, they are intended to be standards, not merely guidelines. They would be subject to revision, however, at the next quinquennial review. The EPA believes that the aircraft manufacturers must be given design standards now for the 1985 time period if the maximum amount of noise control is to be designed into the aircraft from the beginning. To promulgate only the 80 FAR 36 standards, for instance, would be to make mandatory only that technology which would likely come into the market place of its own accord without government regulation although, perhaps, on a slower schedule.

(5) *Major Acoustical Change Airplanes.* Compliance noise levels, applicable to airplanes with major acoustical changes to older type designs, shall be represented by the current technology levels to be promulgated by the FAA, whether as proposed in NPRM 75–37 or in the ICAO CAN/4 report or some compromise of the two.

C4 TAKEOFF CONDITIONS

Section C36.7 of Appendix C specifies takeoff test conditions relative to (1) the power or thrust which must be maintained to a specific height above the runway of the airport (HHA), (2) the permitted power or thrust cutback, (3) the airplane speed, and (4) the airplane configuration.

In regard to the test conditions relative to item (1) above, § C36.7(b) requires takeoff power or thrust be used from the start of takeoff roll to 1000 feet HAA for airplanes powered by two and three engines and to only 700 feet HAA for airplanes powered by four or more engines. The FAA noise certification tests show that it is both practicable and reasonable, as well as safer and less noise polluting, for four engine current technology airplanes to reach 1000 feet HAA over the takeoff measuring point. Therefore, since there is no longer any need for such discrimination for current technology airplanes, the EPA has recommended that the alternative height of 700 feet HAA, permitted in § C36.7(b) for airplanes powered by more than three engines, be eliminated.

Section C36.7(c) of the takeoff test conditions permits a power or thrust cutback to specified limits. The original purpose of that cutback was to establish a safe operating procedure and associated noise level for minimizing the noise impact on near downrange noise sensitive communities. It appears that this cutback procedure has not been used to any significant extent in normal air carrier operations. Nevertheless, the EPA believes that the thrust cutback procedure provides useful information on the noise reduction that can be expected close to the airport by safe operating procedures. Furthermore, the EPA believes that the noise produced by the airplane without power or thrust reduction is important for use in analyzing community noise impact. Therefore, in order to obtain this information the EPA recommends that paragraph (c) of § C36.7 be amended by adding a sentence at the end of that paragraph which would provide that if compliance with the noise levels of § C36.5 is met with power or thrust reduction then additional tests must be conducted without power or thrust reduction and the noise levels achieved under those tests be reported for informational purposes.

Section C36.7(d) of the takeoff test conditions requires the airplane minimum speed to be V2+10 knots which must be attained as soon as practical after liftoff and maintained throughout the takeoff noise test. The original purpose was to insure that the measured noise levels represented airplanes op-

erating at takeoff speeds safe for routine line operations. It appears that this requirement permits too wide a variation in the duration correction inherent in the computations for Effective Perceived Noise Level. Furthermore, for some airplanes, the all engines operating speeds (at 35 or 50 feet for turbine powered or propeller driven airplanes, respectively) are greater than V2+10. The EPA believes, therefore, that the test speed should not be less than V2+10 or the all engines operating speed, whichever is greater, with limitations in the form of tolerances, of which±3 knots appears reasonable.

C5 APPROACH TEST CONDITIONS

Section C36.9 of Appendix C prescribes approach test conditions relative to (1) the airplane's configuration, (2) the glide angle, (3) the approach speed, and (4) the power or thrust. FAA noise certification tests conducted since 1969 show that the approach test conditions are satisfactory except for the configuration requirements prescribed in paragraph (b) of that section. Under that paragraph the airplane's configuration used in showing compliance with the noise levels of § C36.5(a) must be the same as the one used in showing compliance with the landing requirements in the airworthiness regulations for the type certification of the airplane. If more than one configuration is used for airworthiness certification, the configuration that is most critical from a noise standpoint must be used for compliance with paragraph (b) of § C36.9. The EPA believes there is no longer any justification for this requirement. Instead, the EPA believes it would be more appropriate to require compliance for one flap position less than the maximum landing flap setting certificated for airworthiness. Such a test condition would further support a recommendation that has been submitted by EPA and published by the FAA (40 FR 44256) that would amend the general operating rules of Part 91 to require the use of a reduced flap setting procedure for approach and landing. Since the use of such a reduced flap setting procedure would achieve substantial noise reductions, it should be used to show compliance with the approach test conditions of § C36.9(b).

As proposed herein, § C36.9 would be amended by deleting the last sentence of paragraph (b) of that section which requires the use of an approach configuration most critical from the noise standpoint (if more than one configuration is used to show compliance) and inserting in lieu thereof the following flap setting requirement: "If more than one flap setting is used in showing compliance with the landing requirements in the airworthiness regulations constituting the type certification basis of the airplane, one flap position less than the maximum certified for the airplane must be used."

C6. ACOUSTICAL CHANGE APPROVALS

As defined in § 21.93(b) of the Federal Aviation Regulations, any voluntary change in the type design of a transport category or turbojet engine powered airplane that may increase the noise levels created by the airplane is an "acoustical change". Generally, the most important acoustical changes are related to airplane growth. A new airplane design is generally "grown" over its lifetime, either by increasing its capacity or range. Both of these involve increased public air transportation capabilities. To support this growth, powerplants for these airplanes must be designed so that they too can be grown. From the engine manufacturer's point of view, engine growth also allows an engine to compete over a broader range of airplane applications. Allowance for such growth is a basic factor in the economic viability of aircraft programs. Unfortunately, engine growth generally is accompanied by increased noise. An increase in thrust is usually accomplished by increasing temperatures and pressures in the engine core, thus increasing the core engine exhaust velocity and decreasing the by-pass ratio. The effect of this procedure is that the growth engine is noiser than would be an engine of equal thrust designed with the same performance parameters as the base engine. In addition, a growth version of a given airplane design will frequently have poorer climb characteristics and will, therefore, be at lower altitude when it passes over the 3.5 n.m. takeoff measurement point. Hence, the takeoff noise level in particular is quite sensitive to airplane growth.

The FAA is NPRM 75–37 has proposed to increase the severity of the acoustical change requirements for airplanes that comply with existing Appendix C. That proposal would limit the noise escalation associated with the growth of existing airplane types by introducing more stringent requirements when acoustical change applications are made after the date of the NPRM (5 November 1975). The noise escalation associated with the growth of new airplane types would be limited to the compliance noise levels specified in § 36.7(a) of that proposal for the particular type of airplane on which the acoustical change is to be made.

The EPA believes that the technology capability exists for further controlling, to a reasonable extent, those airplanes as they are grown and, therefore, has no objections to the FAA proposed modifications to § 36.7(a).

D. HEALTH AND WELFARE

The Noise Control Act of 1972 defines environmental noise as "the intensity, duration, and the character of sounds from all sources". The EPA has chosen the equivalent A-weighted sound pressure level (Leq) as its basic measure for environmental noise. There are two time intervals of interest in the use of Leq for noise impact assessment. The smallest interval of interest is one hour usually considered the "design hour" of a day. The primary interval of interest for residential land uses is a twenty four hour period, with a weighting applied to nighttime noise levels to account for the increased sensitivity with the decrease in background noise at night. This twenty-four hour weighted equivalent level is denoted the Day-Night Level (Ldn).

In its report to Congress on the Aircraft/Airport Noise Study, the EPA recognized that the direct readily quantifiable effects of noise on public health and welfare are the potential for producing a permanent loss in hearing acuity, interference with speech communications, and the generation of annoyance. The Levels Document specifically identified the following two long-term average levels of cumulative noise exposure as requisite to protect public health and welfare with an adequate margin of safety:

A Day-Night Level (Ldn) no greater than 55 dB to protect against annoyance (including interference with speech communication) and

An Equivalent Noise Level (Leq) no greater than 70 dB, to protect against significant adverse effects on hearing.

Two single one-way runway airports were chosen to be indicators of the noise impact resulting from the implementation of the various options for compliance noise levels. The first runway pertains to large air-carrier airports and the second to general aviation airports. The air-carrier airport is represented by a runway 15,000 ft. in length enclosed by an imaginary rectangle whose dimensions are 27,000 x 3,000 ft. (2.91 sq. mi.). The general aviation airport is represented by a runway 6,000 ft. in length enclosed by an imaginary rectangle whose dimensions are 18,000 x 3,000 ft. (1.94 sq. mi.). These dimensions were chosen to be compatible with the Part 36 measuring points except that the takeoff point for the general aviation airports was reduced from 3.5 nautical miles to 2.0 nautical miles to provide symmetry and to be more representative of the smaller land areas characteristic of those airports.

The rectangles enclosing the airports can be considered as indicators of land areas that, typically, suffer substantial noise impact. Land areas which are noise impacted by aircraft operations should be owned or controlled by airport authorities for airport functional purposes; or the land should be used and can reasonably be expected to continue to be used in a way which is compatible with the noise levels to which it is exposed; or the development rights of such land should be purchased such that only development compatible with the airport noise levels is allowed.

It is generally agreed that a Ldn level of 75 dB is an unacceptable exposure level for people in normally constructed homes. A Ldn level of 65 dB is a reasonable objective for airport neighborhood communities because present limited data indicate that, at some airports, a Ldn contribution of noise from aircraft of less than 65 dB is difficult to distinguish from other ambient noise, given the environmental noise levels (other than from aircraft) around those airports. However, as indicated in the Levels Document, effects from noise occur at Ldn levels below 65 dB and further analysis is needed in the future to refine

further practical objectives for airport noise abatement.

The indicator rectangles serve the purpose of providing a standard fence within which the effectiveness of the compliance noise level options may be compared in a meaningful and consistent manner. The particular dimensions of the rectangles are significant because they are compatible with the FAR 36 measuring points which permits the noise data obtained from the FAR 36 tests to be utilized directly without the need for lengthy computations. Furthermore, the rectangular dimensions are large enough to enclose meaningful noise exposure contours and small enough to implement noise control through compatible land use without experiencing unreasonable costs.

Many airports, of course, have more than one runway with mixed directional operations and a single one-way runway would not be a realistic representation of those airports. Nevertheless, for airports with more than one runway, appropriate rectangles could be superimposed on each of the runways with the composite perimeter indicative of a standard fence.

In the project report (Ref 5), comparisons are made of the effectiveness of the compliance noise levels in terms of specific Ldn contours lying within the rectangles enclosing the air-carrier and general aviation runways. In regard to large air-carrier airports, an example was chosen of a typical mix of airplanes operating from a one-way runway at a rate of 441 takeoffs and landings each per day. The analysis shows that if all airplanes complied exactly with the 69 FAR 36 levels, the Ldn 80 contour would barely lie within the rectangle. This example demonstrates that the existing Part 36 requirements are inadequate to prevent severe noise impact (due to 441 takeoff and landing operations) from occurring within the nearly three square miles enclosed by the rectangle. Further analysis with the same example shows that if all airplanes could comply with the FAA levels proposed for current technology, the Ldn 77 contour would lie within the rectangle. This is an improvement of three decibels which, although significant, is not adequate. Carrying this example to its conclusion, if all airplanes could comply with the future technology levels, the Ldn 70 contours would lie well within the rectangle which would indeed be a substantial reduction.

Although the foregoing example assuming 441 takeoffs and landings and future technology compliance levels leads to a 10 dB improvement compared with 69 FAR 36 compliance, the noise impact has not been reduced to the Ldn levels of 65 dB. As mentioned previously, further reductions in noise impact can result from limiting aircraft operations. Assuming the relative mix of aircraft, all of which could comply with the various technology levels, the following tabulation indicates the relationship between the number of operations per day and the noise exposure contour levels that would lie within the rectangles:

Daily number of takeoffs and landings each	Landing contour levels			
	69 FAR 36	FAA	Available	Future
441	80	77	73	70
141	75	72	68	65
45	70	67	63	60
15	65	62	58	55

The foregoing tabulation indicates that compliance with the future technology noise levels would result in the Ldn 65 contour lying within the indicator rectangle when the number of takeoff and landing operations has been reduced from 441 to 141. For most air carrier airport runways, 441 takeoff and landing operations each per day are too large, while 141 or less are realistic. Certainly having the Ldn 70 and Ldn 65 contours lying within three square miles, due to 441 and 141 takeoffs and landings, respectively, are noteworthy achievements especially since that accomplishment would result exclusively from source noise control. Additional noise abatement for the same number of operations can be achieved by implementing noise abatement approach and departure procedures on a site specific basis.

In regard to general aviation airports, an analysis was made similar to that for the large air-carrier airports. An example was chosen of a typical mix of general aviation type airplanes operating from a one-way runway at various rates of takeoffs and landings per day. The following tabulation indicates, in the same manner as was done previously, the relationships between the number of operations per day and the noise exposure contour levels that would lie within the rectangles:

Daily number of takeoffs and landings each	Landing contour levels			
	69 FAR [illegible]	FAA	Available	Future
400	75	71	64	61
127	70	66	59	56
40	65	61	54	51
13	60	56	49	46
4	55	51	44	41

The foregoing tabulation indicates that compliance with the available and future technology noise levels would result in the Ldn 65 contours lying within the indicator rectangle for all numbers of operations listed. Furthermore, for future technology compliance, the Ldn 55 contour would almost lie within the indicator rectangle when the number of takeoffs and landings has been reduced from 400 to 127. For most general aviation airport runways, 127 or less takeoff and landing operations each per day are more realistic than 400.

For the case of general aviation airports, most of which are sited in suburban or rural locations, a Ldn level of 55 dB is a reasonable objective for the airport communities. It should be understood that while the airport neighborhood population is less dense for general aviation airports compared with large air-carrier airports, there are many more of the former and their neighbors are exposed, in general, to less ambient noise and, therefore, expect less noise intrusion.

E. Costs

EPA has not identified the costs, if there would in fact be any significant costs to the manufacturers resulting from regulatory actions such as the proposed amendments to Part 36. For example, the compliance noise levels representing current and available technology are capable of being met by many aircraft being produced today.

Until comparatively recently, noise has largely been considered by the aircraft and engine designers to be a second order effect in optimizing performance and, therefore, was neglected. As noise became important, and techniques were developed for its abatement and control, the designers found that there were benefits beyond those that could be attributed to the energy transfer of noise to performance. In other words, there was performance improvement resulting from the increased knowledge of aircraft and engine design which can be attributed to the requirements for noise control.

The costs of noise control by compatible land use have been recognized as being very high and, in general, are the least cost-effective method of all. Those costs, therefore, will be reduced when the control of aircraft noise at the source results in reduced Ldn contours lying within the indicator rectangles.

Section 611(d) of the Federal Aviation Act of 1958, as amended by Section 7(b) of the Noise Control Act, directs that, in prescribing and amending standards and regulations under this section, the FAA shall, amongst other matters:

"(4) consider whether any proposed standard or regulation is economically reasonable, technologically practicable, and appropriate for the particular type of aircraft, aircraft engine, appliance or certificate to which it will apply * * *"

Accordingly, although the EPA proposes that the FAA adopt this recommended rule on noise levels for turbojet powered airplanes and large propeller driven airplanes, it is recognized that such proposal is predicated primarily on the furtherance of protection of the public health and welfare from aircraft noise, and that the Administrator of the FAA must consider the economic reasonableness of any rules promulgated under Section 611 of the Act.

(Secs. 313(a), 601, 603, and 611 of the Federal Aviation Act of 1958, as amended (49 U.S.C. 1354(a), 1421, 1423, and 1431); Sec. 6(c) of the Department of Transportation Act (49 U.S.C. 1655(c)); Title I of the National Environmental Policy Act of 1969 (42 U.S.C. 4321 et seq.); and Executive Order 11514, March 5, 1970.)

In consideration of the foregoing, it is proposed to amend Part 36 of the Federal Aviation Regulations as follows:

§ 36.1 [Amended]

1. By amending § 36.1(a)(1) by deleting the words "subsonic transport category large airplanes" and inserting in

lieu thereof the words "large propeller driven airplanes".

§ 36.7 [Amended]

2. By amending § 36.7(a) to read as proposed by the FAA in NPRM 75-37, published 5 November 1975 (49 FR 51476).

Appendix C [Amended]

3. By adding a sentence at the end of § C36.1 to read: "Approved equivalent procedures may also be permitted for compliance with the procedures in this Appendix."

4. By amending paragraph (c) of § C36.3 to read as follows:

§ C36.3 *Noise measuring points.*

* * * * *

(c) For the sideline, at the point, on a line parallel to and 0.25 nautical miles from the extended centerline of the runway, where the noise level after liftoff is greatest.

5. By amending paragraph (a) of § C36.5 to read as follows:

§ C36.5 *Noise Levels.*

(a) *General.* Except as provided in paragraphs (b) and (c) of this section, it must be shown by flight tests that the noise levels of the airplane, at the measuring points described in § C36.3, do not exceed the noise levels in subparagraphs (1)-(4) of this paragraph (with appropriate interpolation between weights).

(1) *Airplanes for which an application for a type crtificate is made on or after 1 December 1969 and certain airplanes newly manufactured after that date.* Except as provided in subparagraphs (2) and (3) of this paragraph, each person who applies under Part 21 of this chapter for a type certificate for an airplane or or after Decmber 1, 1969, or who applies after that date under § 21.183 for the original issue of an airworthiness certificate for an airplane for which a type certificate was applied for before that date, must show that the noise levels of the airplane do not exceed the following:

(i) For approach and sideline, 108 EPNdB for maximum weights of 600,000 lbs. or more, less 2 EPNdB per halving of the 600,000 lbs. maximum wight down to 102 EPNdB for maximum weights of 75,000 lbs. and under.

(ii) For takeoff, 108 EPNdB for maximum weights of 600,000 lbs. or more, less 5 EPNdB per halving of the 600,000 lbs. maximum weight down to 93 EPNdB for maximum weights of 75,000 lbs. and under.

(2) *Airplanes for which an application for a type certificate is made on or after 1 January 1980.* Except as provided in subparagraph (4) of this paragraph, each person who applies under Part 21 for a type certificate for an airplane on or after 1 January 1980, must show compliance with the noise levels prescribed and limited by the following formulas, representing available noise control technology, applicable to airplane weights (W) between 10,000 and 1,000,000 pounds:

Sideline: EPNL=7 Log (W)+56
Takeoff: EPNL=12 Log (W)+29
Approach: EPNL=7 Log (W)+60

(3) *Airplanes for which an application for a type certificate is made on or after 1 January 1985.* Each person who applies under Part 21 for a type certificate for an airplane on or after 1 January 1985, must show compliance with the noise levels prescribed and limited by the following formulas, representing future noise control technology, applicable to airplane weights (W) between 10,000 and 1,000,000 pounds:

Sideline: EPNL=7 Log (W)+51
Takeoff: EPNL=12 Log (W)+25
Approach: EPNL=7 Log (W)+57

* * * * *

6. By amending paragraph (b) of § C36.7 to read as follows:

§ *C36.7 Takeoff test conditions.*

* * * * *

(b) Takeoff power or thrust must be used from the start of the takeoff to the point at which a height of at least 1,000 feet above the runway is reached.

* * * * *

7. By amending paragraph (c) of § C36.7 by adding a sentence at the end of that paragraph to read:

If compliance with the noise levels of § C36.5 is met with power or thrust reduction, additional tests must be conducted without power or thrust reduction and the noise levels achieved under those tests must be reported for informational purposes.

8. By amending paragraph (d) of § C36.7 to read as follows:

(d) A speed of V2+10 knots or the all-engines-operating speed at 35 feet (for turbine engine powered airplanes) or 50 feet (for reciprocating engine powered airplanes) whichever speed is greater must be attained as soon as practicable after liftoff and must be maintained throughout the takeoff noise test. These tests must be conducted within tolerance speeds of ±3 knots and the noise values measured at the test day speeds must be corrected to the acoustic day reference speeds.

9. By adding a new § C36.8 to read as follows:

§ *C36.8 Alternate takeoff test procedure.*

(a) When the signal to noise ratio obtained by the use of the test conditions prescribed in § C36.7 is too small for satisfactory identification and analysis of the airplane noise, a horizontal flyover procedure must be conducted instead of the test procedure prescribed in that section. The flyover procedure must include at least six horizontal flights over the measuring station at a height of 1,000±30 feet and 10 degrees from the zenith when passing overhead.

(b) Takeoff power or thrust and a speed of at least V2+10 knots must be used during the flyover procedure required by paragraph (a) of this section. In addition, a constant takeoff configuration, selected by the applicant, must be maintained throughout the horizontal flyover procedure.

(c) The noise measurements obtained by the use of the flyover procedure required by paragraph (a) of this section must be corrected for climb performance and speed in accordance with the following formulas:

(1) *Turbojet Powered Airplanes.*

$P=60-20 \log [(21266-D35) \sin \alpha+35]+10 \log (VH/VY)$

(2) *Large Propeller Driven Airplanes.*

$P=60-20 \log [(21266-D50) \sin \alpha+50]+10 \log (VH/VY)$

Where:

P = Correction that must be added algebraically to the Effective Perceived Noise Level (EPNL) evaluated under Appendix B, decibels.

$D35$ = Takeoff distance to 35 feet height at maximum certificated takeoff weight, feet.

$D50$ = Takeoff distance to 50 feet height at maximum certificated takeoff weight, feet.

VY = Climb speed equivalent to V2+10 knots, or greater if approved, fpm.

R/C = Rate of climb corresponding to climb speed, fpm.

VH = Test speed, averaged for all horizontal flights, at the aircraft position for which the tone corrected perceived noise level is maximum, fpm.

α = arcsine $(R/C/(VY))$ = angle of climb. degrees.

10. By changing the last sentence of paragraph (b) of § C36.9 to read:

If more than one flap setting is used to show compliance with the landing requirements in the airworthiness regulations constituting the type certification basis of the airplane, one flap position less than the maximum certificated for the airplane must be used.

The FAA has not received from the Environmental Protection Agency an inflationary impact assessment for the recommended regulation set forth in this notice.

Issued in Washington, D.C., on October 21, 1976.

CHARLES R. FOSTER,
Director of Environmental Quality.

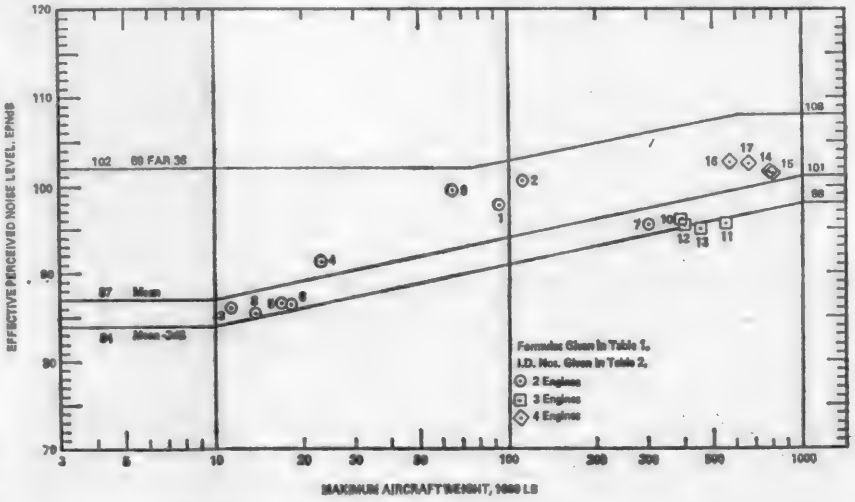


FIGURE 1. NOISE LEVELS VS WEIGHT FOR CURRENT TECHNOLOGY EXISTING AIRPLANES. (a) SIDELINE AT 0.25 NAUTICAL MILE (463 METERS).

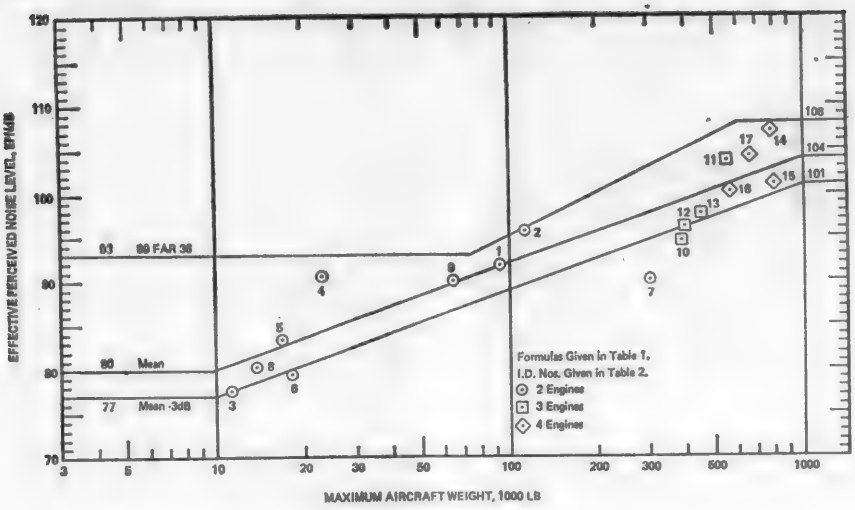


FIGURE 1. NOISE LEVELS VS WEIGHT FOR CURRENT TECHNOLOGY EXISTING AIRPLANES.
(b) TAKEOFF AT 3.5 NAUTICAL MILES (6,482 METERS).

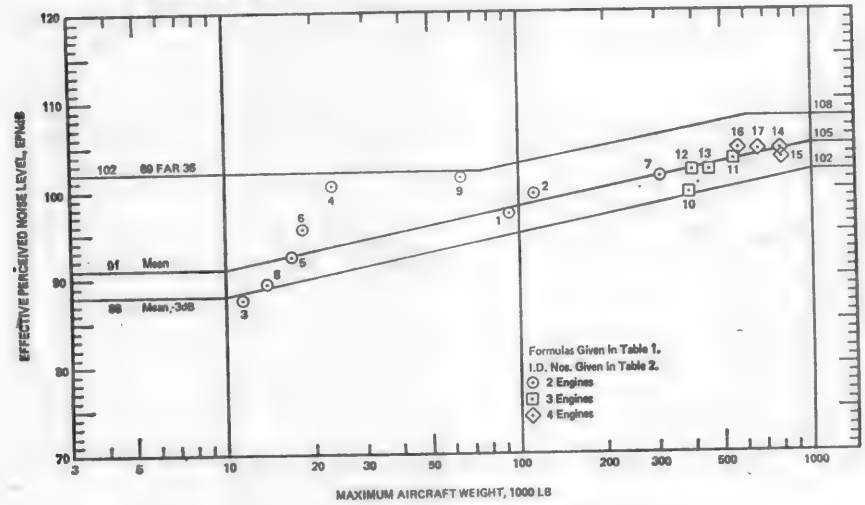


FIGURE 1. NOISE LEVELS VS WEIGHT FOR CURRENT TECHNOLOGY EXISTING AIRPLANES.
(c) APPROACH AT 1.0 NAUTICAL MILE (1,852 METERS).

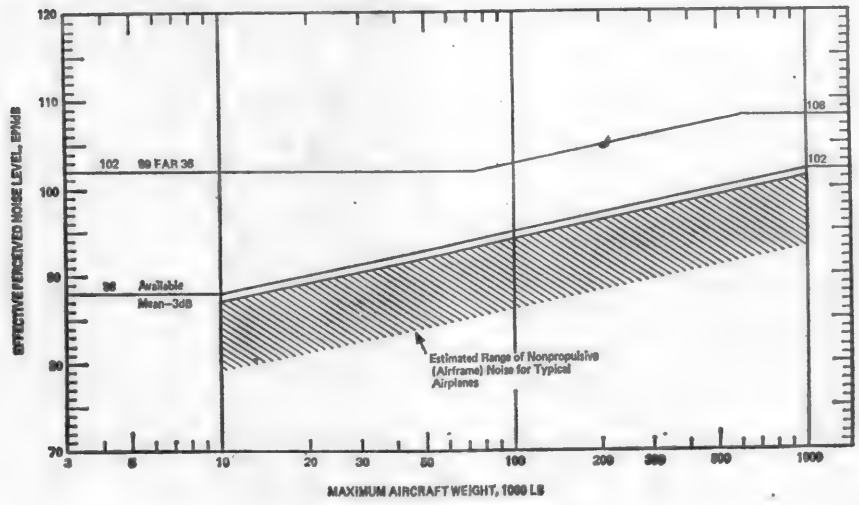

EFFECTIVE PERCEIVED NOISE LEVEL, EPNdB
102 99 FAR 36
98 Available
Mean-3dB
Estimated Range of Nonpropulsive (Airframe) Noise for Typical Airplanes
MAXIMUM AIRCRAFT WEIGHT, 1000 LB

FIGURE 2. NONPROPULSIVE APPROACH NOISE FOR TYPICAL AIRPLANES.

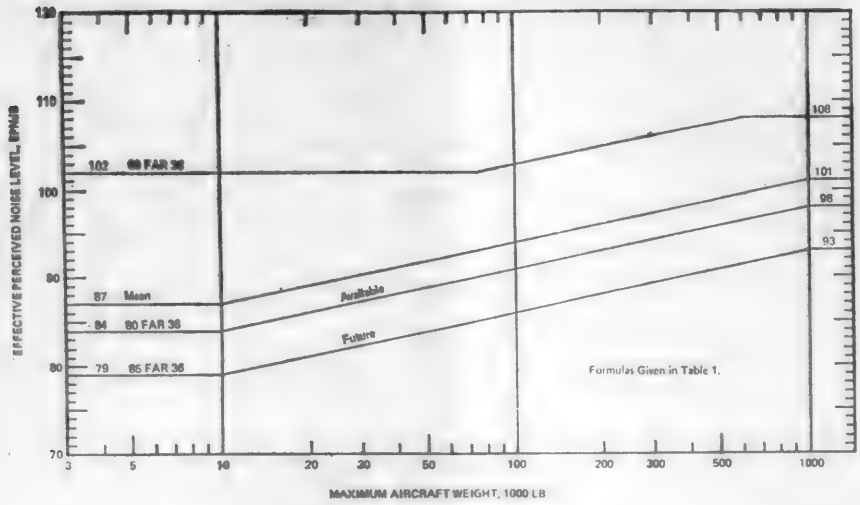


FIGURE 3 COMPLIANCE NOISE LEVELS FOR AVAILABLE AND FUTURE TECHNOLOGY AIRPLANES
(a) SIDELINE AT 0.25 NAUTICAL MILE (463 METERS).

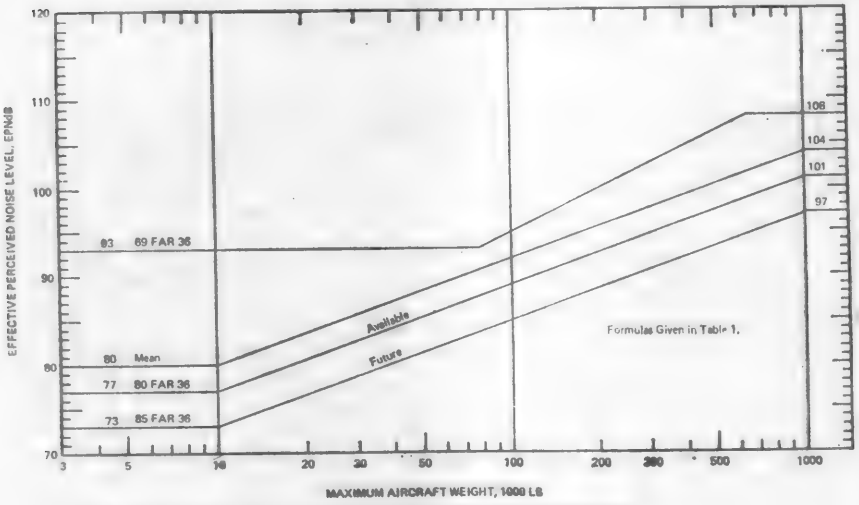


FIGURE 3 COMPLIANCE NOISE LEVELS FOR AVAILABLE AND FUTURE TECHNOLOGY AIRPLANES.
(b) TAKEOFF AT 3.5 NAUTICAL MILES (6,482 METERS).

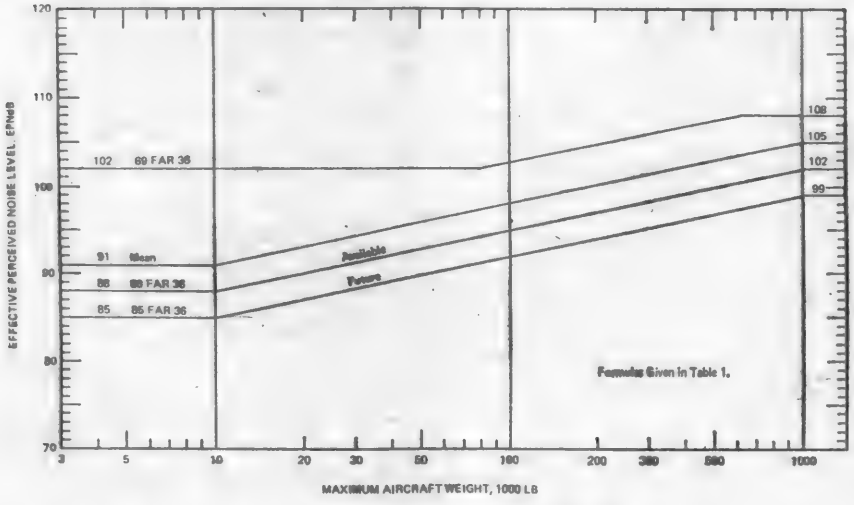


FIGURE 3. COMPLIANCE NOISE LEVELS FOR AVAILABLE AND FUTURE TECHNOLOGY AIRPLANES.
(c) APPROACH AT 1.0 NAUTICAL MILE (1,852 METERS).

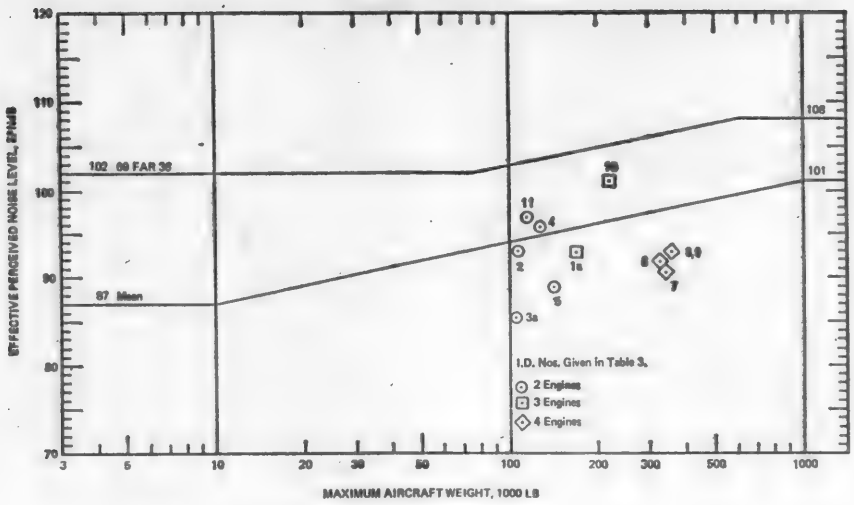


FIGURE 4. PREDICTED NOISE LEVELS FOR MAJOR ACOUSTICAL CHANGE AIRPLANES.
(a) SIDELINE.

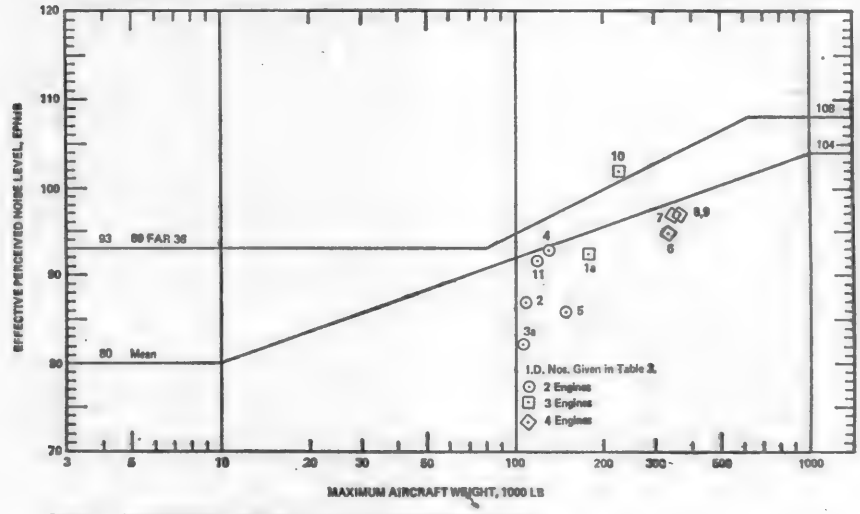


FIGURE 4. PREDICTED NOISE LEVELS FOR MAJOR ACOUSTICAL CHANGE AIRPLANES.
(b) TAKEOFF.

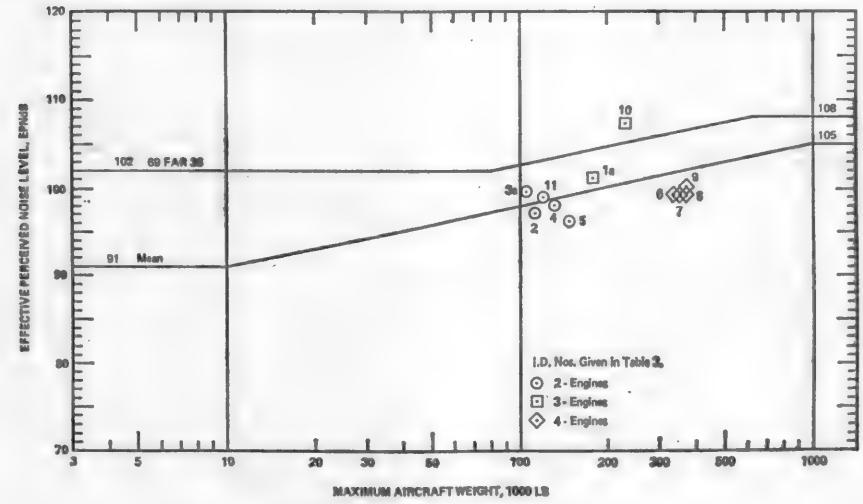


FIGURE 4. PREDICTED NOISE LEVELS FOR MAJOR ACOUSTICAL CHANGE AIRPLANES.
(c) APPROACH.

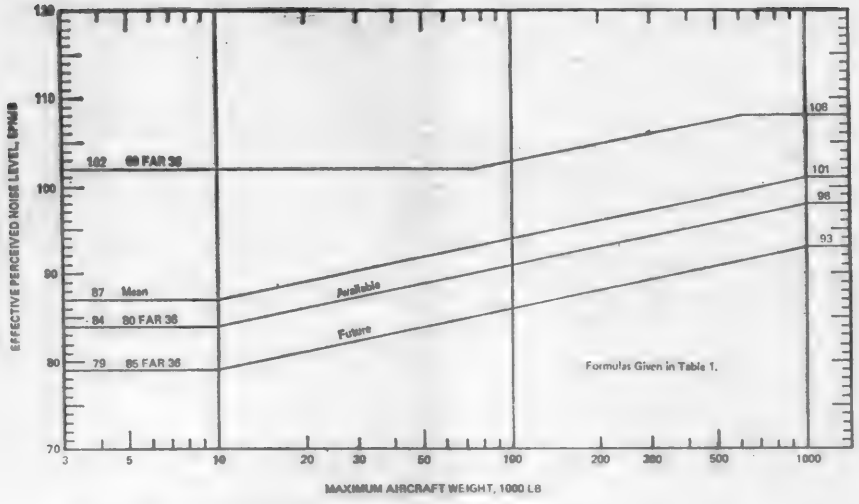


FIGURE 3. COMPLIANCE NOISE LEVELS FOR AVAILABLE AND FUTURE TECHNOLOGY AIRPLANES.
(a) SIDELINE AT 0.25 NAUTICAL MILE (463 METERS).

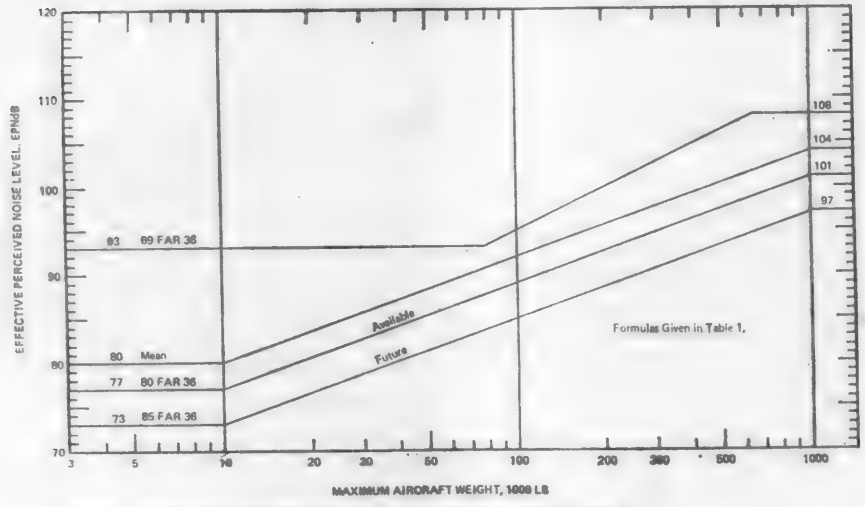


FIGURE 3. COMPLIANCE NOISE LEVELS FOR AVAILABLE AND FUTURE TECHNOLOGY AIRPLANES.
(b) TAKEOFF AT 3.5 NAUTICAL MILES (6,482 METERS).

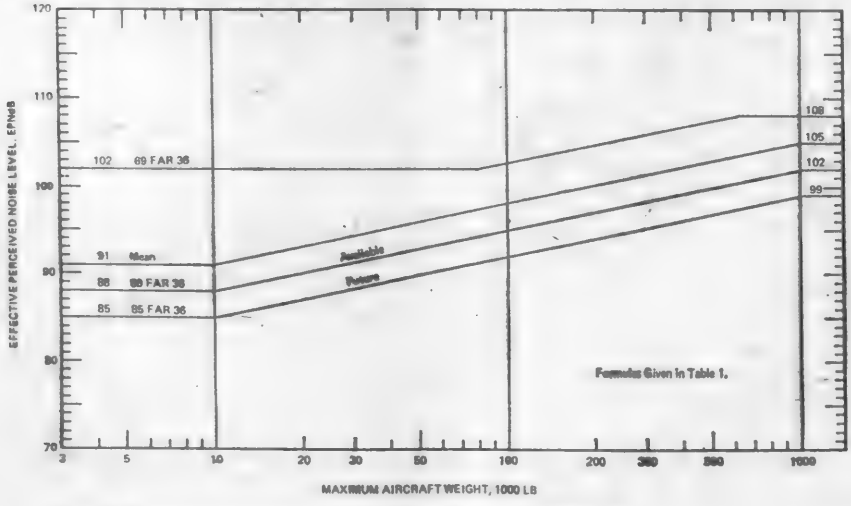


FIGURE 3. COMPLIANCE NOISE LEVELS FOR AVAILABLE AND FUTURE TECHNOLOGY AIRPLANES.
(c) APPROACH AT 1.0 NAUTICAL MILE (1,852 METERS).

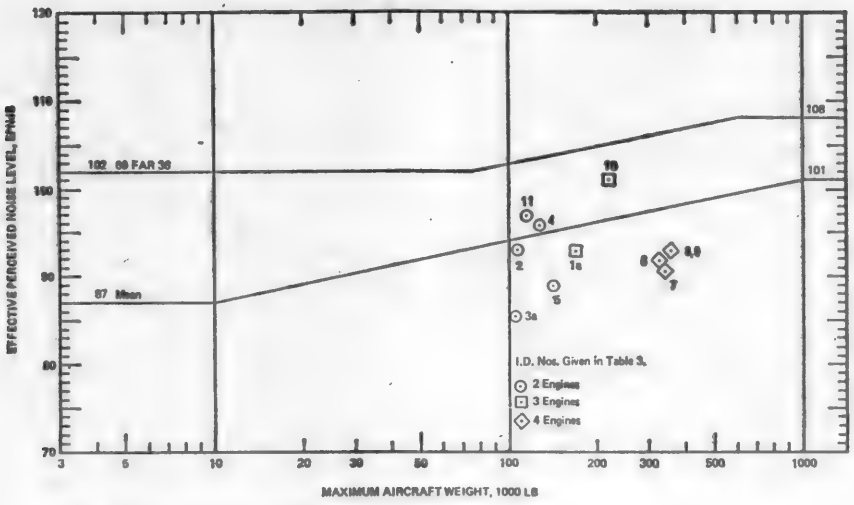


FIGURE 4. PREDICTED NOISE LEVELS FOR MAJOR ACOUSTICAL CHANGE AIRPLANES.
(a) SIDELINE.

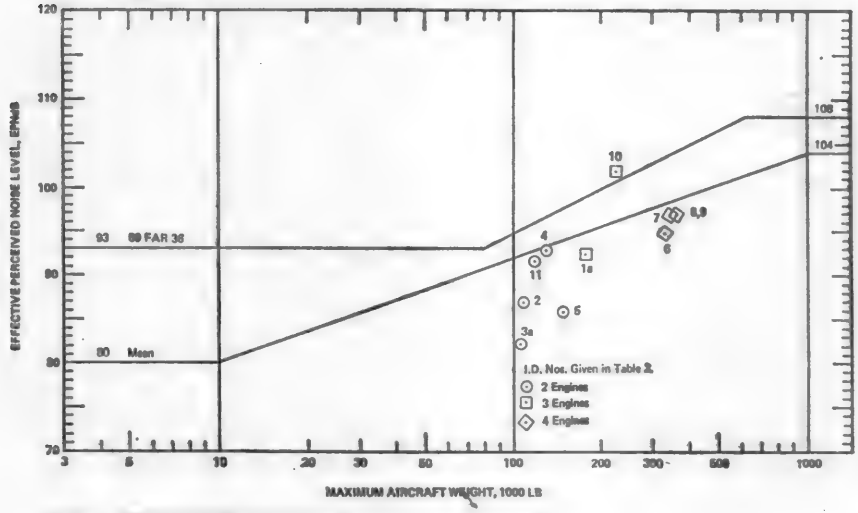


FIGURE 4. PREDICTED NOISE LEVELS FOR MAJOR ACOUSTICAL CHANGE AIRPLANES.
(b) TAKEOFF.

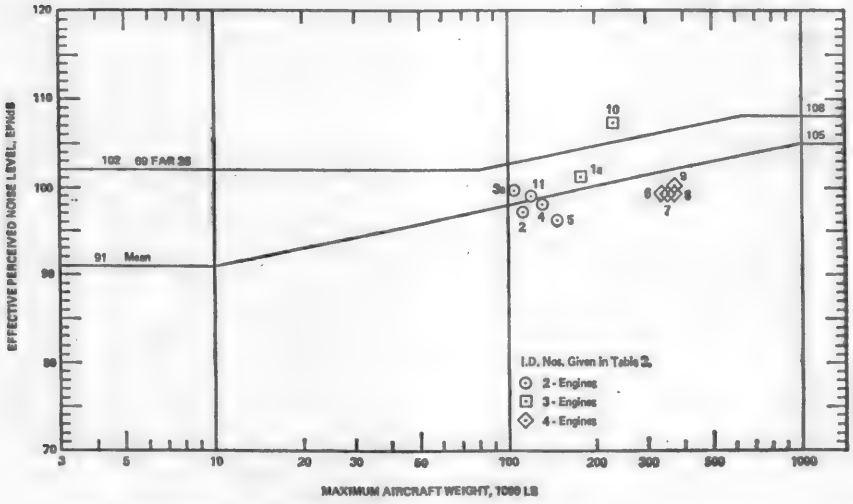


FIGURE 4. PREDICTED NOISE LEVELS FOR MAJOR ACOUSTICAL CHANGE AIRPLANES.
(c) APPROACH.

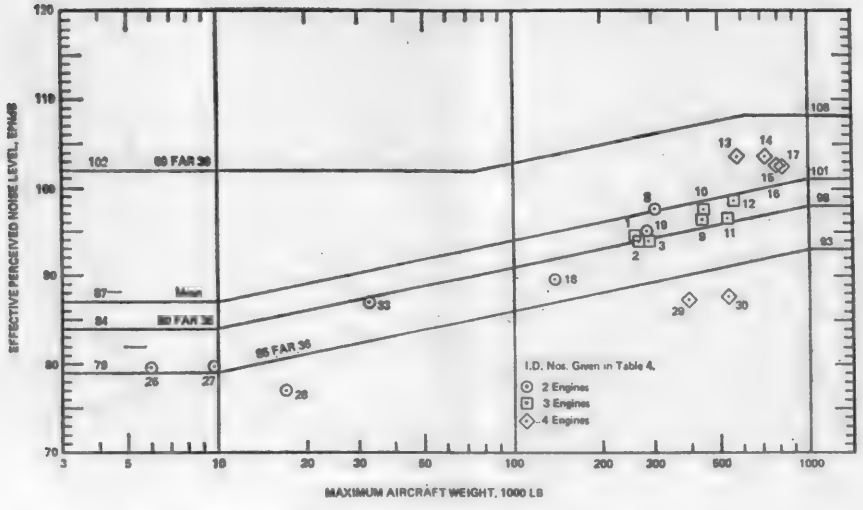


FIGURE 5. PREDICTED NOISE LEVELS FOR NEW TYPE DESIGN AIRPLANES.
(a) SIDELINE.

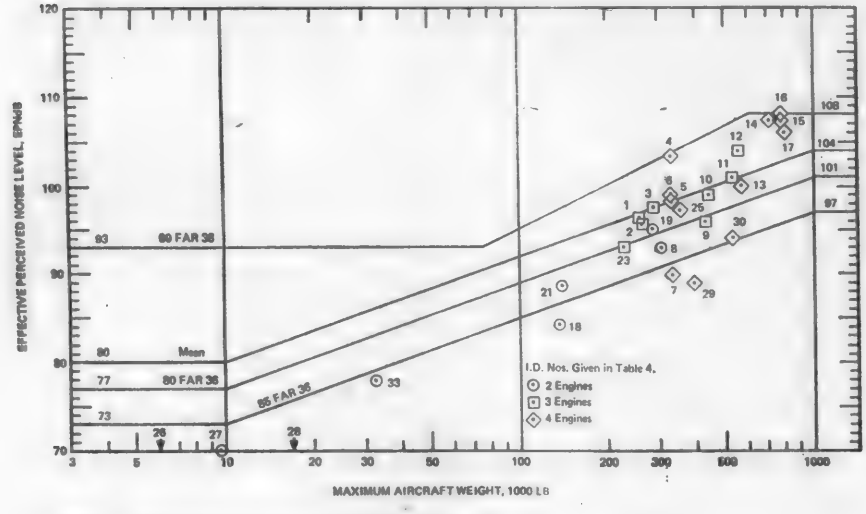


FIGURE 6. PREDICTED NOISE LEVELS FOR NEW TYPE DESIGN AIRPLANES.
(b) TAKEOFF.

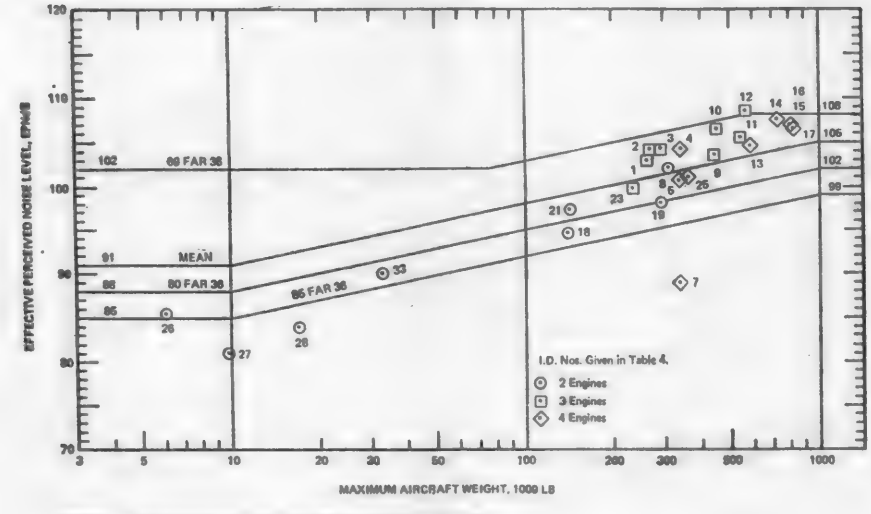


FIGURE 7. PREDICTED NOISE LEVELS FOR NEW TYPE DESIGN AIRPLANES.
(c) APPROACH.

General Formula: EPNL = A LOG(W) + B

Case	Meas. Point	No. of Engines	Constants, dB		Limits				Slope dB Per W/2
					Lower		Upper		
			A	B	W 1000 lb.	EPNL EPNdB	W 1000 lb	EPNL EPNdB	
69 FAR 36	S/L	ALL	6.644	69.611	75	102	600	108	−2.000
	T/O		16.610	12.027		93			−5.000
	APP		6.644	69.611		102			−2.000
FAA WP/69	S/L	2	6.644	60.611	75	93	850	100	−2.000
		3		60.611	212	96		100	
		4		63.611	75	96		103	
	T/O	2	13.288	21.222	89	87	850	100	−4.000
		3		24.222	89	90		103	
		4		27.222	53	90		106	
	APP	All	6.644	65.611	75	98	850	105	−2.000
ICAO WP/64	S/L	All	6.644	63.611	75	96	850	103	−2.000
	T/O		16.610	8.027		89	800	106	−5.000
	APP		6.644	65.611		98	850	105	−2.000
Mean of 17 Airplane Sample	S/L	All	7.000	59.000	10	87	1000	101	−2.107
	T/O		12.000	32.000		80		104	−3.612
	APP		7.000	63.000		91		105	−2.107
80 FAR 36 Available Technology	S/L	All	7.000	56.000	10	84	1000	98	−2.107
	T/O		12.000	29.000		77		101	−3.612
	APP		7.000	60.000		88		102	−2.107
85 FAR 36 Future Technology	S/L	All	7.000	51.000	10	79	1000	93	−2.107
	T/O		12.000	25.000		73		97	−3.612
	APP		7.000	57.000		85		99	−2.107

TABLE 1. FORMULAS FOR COMPLIANCE NOISE LEVEL CURVES.

I.D. No.	Airplane Type	Engine		Max. Wt. W KLB	Max. Thrust		T/W	Noise Level, EPNdB				Notes & Source of Data
		No.	Type		Per Eng. T KLB	Tot. T KLB		S/L @ 0.25 NM	T/O @ 3.5 NM With C/B	T/O @ 3.5 NM No C/B	App @ 1.0 NM	
1	DC-9-30	2	JT8D-7A	94.0	14.0	28.0	0.298	97.8	91.7	–	97.0	(1) FAA
2	DC-9-40	2	JT8D-15	114.0	15.5	31.0	0.272	100.5	95.8	–	99.4	(1) FAA
3	Cessna 500	2	JT15D-1	11.5	2.2	4.4	0.383	86.1	–	77.7	87.7	(2) FAA
4	Sabre NA265-80	2	CF700-2D-2	23.3	4.32	8.63	0.370	91.3	–	90.7	100.2	(3) FAA
5	Learjet 35, 36	2	TFE 731-2	17.0	3.5	7.0	0.412	86.7	–	83.4	92.2	(2) FAA
6	Falcon 10	2	TFE 731-2	18.3	3.5	7.0	0.383	86.4	79.6	82.9	95.3	(4) FAA
7	Airbus A 300B	2	CF6-50A	302.0	49.0	98.0	0.325	95.3	90.2	–	101.3	(5) FAA
8	Corvette SN-601	2	JT15D-4	13.89	2.5	5.0	0.360	85.4	–	80.4	89.5	(6) FAA
9	F-28-1000	2	SPEY 555-15	65.0	9.85	19.7	0.303	99.5	90.0	–	101.2	(7) FAA
10	DC-10-10	3	DF6-6D	386.5	40.3	120.9	0.313	96.0	–	94.6	99.2	(6) FAA
11	DC-10-30	3	CF6-50A	550.0	48.4	145.2	0.264	95.7	–	103.7	103.0	(6) FAA
12	L-1011-1	3	RB 211-22C	398.0	42.0	126.0	0.318	95.2	–	96.0	101.5	(8) FAA
13	L-1011-100	3	RB 211-22B	450.0	42.0	126.0	0.280	94.9	–	97.4	101.5	(8) Lockheed
14	B-747-200B	4	JT9D-7W	785.0	47.0	188.0	0.239	101.5	–	107.0	104.0	(3) Boeing
15	B-747-200B	4	CF6-50E	800.0	52.5	210.0	0.263	101.5	101.0	107.0	103.0	(3) Boeing:
16	B-747-SR	4	JT9D-7A	570.0	47.67	190.7	0.335	102.5	–	100.0	104.0	(3) Boeing
17	B-747-SP	4	JT9D-7A	660.0	47.67	190.7	0.289	102.5	–	104.0	104.0	(9) Boeing

Approach Flaps: (1) 50°, (2) 40°, (3) 25°, (4) 52°, (5) 20° Slats, (6) 35°, (7) 42°, (8) 33°, (9) 30°.

TABLE 2. NOISE LEVELS FOR CURRENT TECHNOLOGY EXISTING AIRPLANES.

I.D. No.	Airplane Type	Engine No.	Engine Type	Max. Wt. W KLB	Max. Thrust Per Eng. KLB	Max. Thrust Tot. T KLB	T/W	Noise Level, EPNdB S/L @ 0.25 NM	Noise Level, EPNdB T/O @ 3.5 NM With C/B	Noise Level, EPNdB T/O @ 3.5 NM No C/B	Noise Level, EPNdB App @ 1.0 NM	Notes & Source of Data
1a	B-727-200	3	JT8D-15	172.5	15.6	46.8	0.289	92.8	92.4	98.9	100.9	(1) NASA
1b	B-727-200	3	JT8D-15	172.5	16.6	49.8	0.289	92.8	92.4	98.9	101.5	(2) NASA
2	DC-9-32	2	JT8D-109	108.0	16.6	33.2	0.307	93.0	87.0	93.0	97.0	(3) NASA
3a	B-737-200	2	JT8D-109	103.0	16.6	33.2	0.322	85.7	82.5	84.0	95.5	(1) NASA
3b	B-737-200	2	JT8D-109	103.0	16.6	33.2	0.322	85.7	82.5	84.0	100.8	(2) NASA
4	DC-9	2	JT8D-209	127.0	18.0	36.0	0.283	96.0	93.0	99.0	98.0	Douglas Noise Levels ± 3 dB and Max. App. Flaps
5	DC-9	2	CFM56/JT10D	142.0	--	--	--	89.	86.0	91.0	99.9	
6	DC-8-61	4	CFM56/JT10D	325.0	--	--	--	92.0	96.0	98.0	99.0	
7	DC-8-62	4	CFM56/JT10D	335.0	--	--	--	91.0	97.0	98.0	99.0	
8	DC-8-63	4	CFM56/JT10D	356.0	--	--	--	87.0	97.0	100.0	96.3	
9	DC-8-63F	4	CFM56/JT10D	356.0	--	--	--	93.0	97.0	100.0	100.0	
10	B-727-300B	3	JT8D-217	222.0	19.0	57.0	0.257	101.0	102.0	--	107.0	Boeing
11	BAC-111-700	2	Spey 604-14	117.0	16.9	33.8	0.289	97.0	92.0	--	99.0	BAC

Approach Flaps; (1) 30°, (2) 40°, (3) 50°

TABLE 3. PREDICTED NOISE LEVELS FOR MAJOR ACOUSTICAL CHANGE AIRPLANES.

I.D No.	Airplane Type	Engine No.	Engine Type	Max. Wt. W KLB	Max. Thrust Per Eng. KLB	Max. Thrust Tot. T KLB	T/W	Noise Level, EPNdB S/L @ 0.25 NM	Noise Level, EPNdB T/O @ 3.5 NM With C/B	Noise Level, EPNdB T/O @ 3.5 NM No C/B	Noise Level, EPNdB App @ 1.0 NM	Notes & Source of Data
1	B-7x7	3	CFM56/JT10D	256.0	--	--	--	94.3	--	96.5	102.9	(1) Boeing
2	B-7x7	3	CFM56/JT10D	263.0	--	--	--	93.9	--	95.7	104.1	(1) "
3	B-7x7	3	CFM56/JT10D	285.0	--	--	--	93.9	--	97.7	104.1	(1) "
4	Narrow Body	4	Quiet Eng. A	330.0	--	--	--	--	--	103.3	104.1	(1) (2) "
5	Narrow Body	4	Quiet Eng. A	330.0	--	--	--	--	--	98.2	100.6	(1) (3) (4) "
6	Narrow Body	4	Quiet Eng. A	330.0	--	--	--	--	--	98.9	--	(1) (3) (5) "
7	Narrow Body	4	Quiet Eng. A	330.0	--	--	--	--	--	90.0	95.0	(3) (6) "
8	New Type Design	2	CF6	302.0	--	--	--	97.5	--	93.0	102.0	(1) "
9	New Type Design	3	RB-211	430.0	--	--	--	96.5	--	98.0	103.5	(1) "
10	New Type Design	3	CF6	440.0	--	--	--	97.5	--	99.0	106.5	(1) "
11	New Type Design	3	JT9D	530.0	--	--	--	98.5	--	101.0	105.5	(1) "
12	New Type Design	3	CF6	555.0	--	--	--	99.5	--	104.0	108.5	(1) "
13	New Type Design	4	JT9D	570.0	--	--	--	103.5	--	100.0	104.5	(1) "
14	New Type Design	4	JT9D	710.0	--	--	--	103.5	--	107.2	107.6	(1) "
15	New Type Design	4	JT9D Wet	775.0	--	--	--	107.5	--	107.2	108.9	(1) "
16	New Type Design	4	JT9D Dry	775.0	--	--	--	103.5	--	108.0	108.9	(1) "
17	New Type Design	4	CF6	800.0	--	--	--	102.5	--	106.1	108.5	(1) "
18	BAC-111-600	2	CFM56	137.0	22.0	44.0	0.321	89.7	84.4	--	94.7	(1) BAC
19	DC-X-200	2	CF6-80C	283.0	51.0	102.0	0.360	96.0	--	95.0	98.0	(1) AWAST

(1) Max. App. Flaps: (2) Peripheral Sam: (3) Inlet & Exhaust Sam Rings:
(4) Boeing Nacelle: (5) GE Nacelles (6) NASA Original Goal:

TABLE 4. PREDICTED NOISE LEVELS FOR NEW TYPE DESIGN AIRPLANES.
(a) I.D. NOS. 1 THRU 19

I.D. No.	Airplane Type	Engine No.	Engine Type	Max. Wt. W KLB	Max. Thrust Per Eng. KLB	Max. Thrust Tot. T KLB	T/W	Noise Level, EPNdB S/L @ 0.25 NM	Noise Level, EPNdB T/O @ 3.5 NM With C/B	Noise Level, EPNdB T/O @ 3.5 NM No C/B	Noise Level, EPNdB App @ 1.0 NM	Notes & Source of Data
20	Twin-Jet	2	CFM56	140.0	22.0	44.0	0.314	—	—	89.75	98.75	(1) GE Co.
21	Twin-Jet	2	CFM66	140.0	22.0	44.0	0.314	—	—	88.75	97.25	(2) "
22	Tri-Jet	3	CFM56	230.0	22.0	66.0	0.287	—	—	94.75	101.50	(1) "
23	Tri-Jet	3	CFM66	230.0	22.0	66.0	0.287	—	—	93.00	99.75	(2) "
24	Quad-Jet	4	CFM56	355.0	22.0	88.0	0.248	—	—	98.75	102.25	(1) "
25	Quad-Jet	4	CFM66	355.0	22.0	88.0	0.248	—	—	97.25	101.00	(2) "
26	G.A. Twin-Jet	2	QCGAT	6.0	1.290	2.58	0.430	79.5	—	68.5	85.5	NASA
27	G.A. Twin-Jet	2	QCGAT	9.8	2.224	4.45	0.454	79.5	—	70.0	81.0	
28	G.A. Twin-Jet	2	QCGAT	17.0	4.369	8.74	0.514	77.0	—	69.0	84.0	
29	LH2 Subsonic	4	Liq. Hydrogen	391.7	28.70	114.80	0.293	87.2	—	89.2	—	ICAO Bulletin
30	Jet A Subsonic	4	Fossil-Fuel	532.2	32.69	130.78	0.246	87.8	—	94.2	—	
31	LH2 Supersonic	4	Liq. Hydrogen	368.0	46.01	184.04	0.500	105.9	—	104.3	—	
32	Jet A Supersonic	4	Fossil-Fuel	750.0	89.51	358.04	0.477	108.0	—	108.0	—	
33	Lear Star 600	2	Lycoming ALF502	32.5	7.50	15.00	0.460	87.0	78.0	—	90.0	AW&ST

(1) Short Duct; (2) Long Duct

TABLE 4. PREDICTED NOISE LEVELS FOR NEW TYPE DESIGN AIRPLANES.
(b) I.D. NOS. 20 THRU 33

[FR Doc.76-31464 Filed 10-27-76;8:45 am]

[14 CFR Part 36]

[Docket No. 15131; Notice No. 75-37C]

NOISE STANDARDS; AIRCRAFT TYPE AND AIRWORTHINESS CERTIFICATION

Proposed Alternative Noise Reduction Stages and Acoustical Change Requirements for Subsonic Transport Category Large Airplanes, for Subsonic Turbojet Powered Airplanes, and for Single Engine Transport Category Airplanes

On November 5, 1975, the Federal Aviation Administration published Notice No. 75-37 (40 FR 51476) which proposed to amend Part 36 of the Federal Aviation Regulations (14 CFR Part 36) to provide for three stages of noise reduction, to require applications for new type certificates to comply with reduced noise limits, and to increase the stringency of acoustical change requirements for airplanes that comply with current Appendix C noise limits, as applied to subsonic transport category large airplanes and to subsonic turbojet powered airplanes. Subsequently, the FAA published a supplemental notice of proposed rule making, Notice 75-37B (41 FR 5641; February 2, 1976), which proposed to apply the proposals contained in Notice 75-37 to single engine airplanes in the transport category, regardless of engine type.

The purpose of this further supplemental notice of proposed rule making is to propose alternative noise limits to those proposed in Notices 75-37 and 75-37B, that are generally more restrictive than those previously proposed. However, this notice does not withdraw from further consideration or possible adoption those noise limits contained in Notices 75-37 or 75-37B. Since the FAA may adopt amendments based on the proposals contained in Notices 75-37 and 75-37B, in this notice, in any future notice, or in some combination of them, comments concerning each proposal are invited. Since the same regulatory docket will be used for these proposals, to facilitate identification of which proposed rule is being addressed, commentors should identify the proposal contained in this notice as "the alternative (ICAO) noise limits" or a similar identifying reference. The FAA also notes that this supplemental notice affects many of the same sections and paragraphs involved in Notices 75-37 and 75-37B. While the retention of the CFR unit designations is necessary to identify those units affected and to facilitate comparisons of the provisions in submitting comments, commenters are alerted to the potential for confusing the "original" proposed rule (Notices 75-37 and 75-37B) and the "alternative" proposed rule in this notice (Notice 75-37C) in comment discussions.

Interested persons are invited to participate in the making of the proposed rule by submitting such written data, views, or arguments as they may desire. Communications should identify the docket number and be submitted in duplicate to the Federal Aviation Administration, Office of the Chief Counsel, Attention: Rules Docket, AGC-24, 800 Independence Avenue, SW., Washington, D.C. 20591. Comments on the overall environmental aspects of the proposed rule are specifically invited. Information on the economic impact that might result because of the adoption of the proposed rule is also requested. All communications received by the FAA on or before February 28, 1977, will be considered by the Administrator before taking actions on the proposed rule. The proposals contained in this notice may be changed in the light of the comments received. All comments will be available, both before and after the closing date for comments, in the FAA Rules Docket for examination by interested persons.

Any person may obtain a copy of this notice of proposed rule making (NPRM) by submitting a request to the Federal Aviation Administration, Office of Public Affairs, Attention: Public Information Center, APA-430, 800 Independence Avenue, SW., Washington, D.C. 20591, or by calling (202) 426-8058. Communications must identify the notice number of this NPRM. Persons interested in being placed on a mailing list for future NPRMs should also request a copy of Advisory Circular No. 11-2, which describes the application procedure.

The major impetus for this supplemental notice comes from the participation of the United States Government in the International Civil Aviation Organization (ICAO). Annex 16 of the ICAO convention, like FAR Part 36, prescribes maximum noise levels measured at certain specified measuring points. Meeting in Montreal, during January and February, 1975, the Committee on Aircraft Noise (CAN) of ICAO reinstated its Working Group D (WG/D) and requested it to draft modifications to Annex 16. After three meetings, having received the benefits of technical studies carried out by a number of subgroups and individual members, WG/D recommended a comprehensive amendment to Annex 16. That recommended amendment forms the basis for the amendments proposed in this supplemental notice.

While a 120-day comment period is provided in this notice, the CAN Committee of ICAO is scheduled to meet on November 15, 1976; those comments received in the Rules Docket before that meeting will be reviewed in developing positions to be taken by FAA representatives at that meeting.

Due to the international nature of the aviation industry and the importance to the United States economy of that industry, the Federal Aviation Administration has always sought to fairly and equitably standardize national and international aircraft specifications, including environmental standards, such as noise. However, the FAA is also constrained by statutory and policy guidelines in its promulgation of environmental rules. Further, under recently adopted Department of Transportation policies to improve analysis and review of regulations, the FAA is required to evaluate the cost to the private sector, to consumers, and to Federal, State, and local governments of each proposed regulation.

Therefore, in order that potentially affected parties will have an opportunity to comment on the proposed amendment to FAR Part 36, the FAA invites public comment on this supplemental proposal to Notice 75-37. Specific comments are sought on the costs and benefits of this proposal and, where appropriate, on comparisons with the current provision of Part 36, or with the original noise limit proposals contained in Notice 75-37, as modified by Notice 75-37B.

Description of the proposed rule/evaluation of anticipated impacts. Most of

the "alternative noise limits" proposals involve differences in the permissible noise level limits for new and derived aircraft types. Specifically, the separate sideline noise limits for one, two, three, and four-engine airplanes proposed in Notice 75-37 would be replaced by a single limit. The separate takeoff limits would be retained but in a somewhat modified form, while the approach noise limit would be significantly modified only in the upper weight ranges.

The most substantial change being proposed concerns the noise limits for derived versions of aircraft that are already certificated. Aircraft currently certificated for noise using engines with bypass ratios of 2 or less would be allowed to grow up to the present (Stage 2) noise level limits, while those with engines have bypass ratios greater than 2 would be allowed growth up to 3 EPNdB above the proposed Stage 3 limits, provided they do not exceed the Stage 2 limits. Growth versions of aircraft types certificated to Stage 3 limits (those new aircraft types for which applications were made more than six months after the publication of this notice) would only be allowed growth up to the Stage 3 limits.

While the proposed amendment to ICAO Annex 16 does not prescribe noise standards for single engine airplanes, the FAA proposes to make the standards proposed for two-engine airplanes also applicable to single-engine airplanes, regardless of engine category.

In addition, this notice proposes several amendments to the noise test procedure, including measurement distances, engine cutback altitudes, and cutback power or thrust, which, if adopted, would being FAR Part 36 into greater conformity with the proposed ICAO Annex 16 provisions.

The anticipated impacts of the proposals contained in this supplemental notice has been assessed and evaluated to the extent practicable. With respect to current aircraft designs, any increase in fuel consumption and emissions should be significant only on an individual aircraft basis and will exist only in comparison with unsuppressed versions of the quieter aircraft. Compared with present-day design, it is expected that the aircraft covered by the originally proposed rule, and by the alternative proposal contained in this supplement notice will achieve significant improvements in both fuel economy and emissions levels. Thus, if adopted, the proposals in this supplemental notice would neither significantly increase fuel usage on a fleetwide basis nor decrease engine efficiency. Therefore, the FAA believes that the proposals contained in this supplemental notice would not have significant impact on energy use.

In reviewing the anticipated environmental and resultant economic impacts of the proposed rule, a comparison was made of the proposed noise level limits with measured noise levels for aircraft certificated under the current FAR Part 36 which was adopted in December, 1969. This comparison revealed that most entry-into-service versions of two three, and four engine aircraft that are using currently available engines and currently available technology in the design and construction of engine installations and sound attenuation devices already meet the proposed levels. Analyses prepared by members of the ICAC Committee on Aircraft Noise, Working Group B, show that the proposed limits are necessary to preserve those environmental benefits already achieved. However, to accomplish that purpose, the proposal does place some limitations upon the growth of aircraft types. Thus, some economic or inflationary impact may be incurred by some manufacturers.

In order to assess and evaluate the significance of these potential impacts, the FAA reviewed the non-proprietary cost information and data available to it. Further, it solicited additional data from manufacturers of aircraft and aircraft engines. Upon analysis of this information, the FAA believes that the economic/technological factors affecting the decision whether or not to develop and market a derivative aircraft vary considerably from manufacturer to manufacturer and even from aircraft type to aircraft type. Although the economic bases for such decisions are treated with the utmost proprietary caution by the manufacturers, the FAA believes that sufficient data are available to it which indicate that the proposed limits upon growth or derivative aircraft will not seriously inhibit their development or introduction into service.

Therefore, based on currently available data, the FAA believes that the proposal in this supplemental notice will not significantly increase costs to the private sector, to consumers, or to the Federal, state, or local governments; however, the FAA continues to solicit current and appropriate cost data. All available data will be carefully reviewed prior to any future final rule-making action on this and related, or alternately, proposals.

This amendment is proposed under the authority of sections 313(a), 601(a), 603, and 611(b) of the Federal Aviation Act of 1958, as amended (49 U.S.C. 1354(a), 1421, 1423, and 1431(b)); section 6(c) of the Department of Transportation Act (49 U.S.C. 1655(c)); Title I of the National Environmental Policy Act of 1969 (42 U.S.C. 4321, et seq.); and Executive Order 11514, March 5, 1970.

In consideration of the foregoing, as an alternative to adopting the amendments proposed in Notices 75-37 and 75-37B, the Federal Aviation Administration proposes to amend Part 36 of the Federal Aviation Regulations (14 CFR Part 36) as follows:

A. Subpart A

1. Paragraph (a)(2) of § 36.7 would be revised to read as follows:

§ 36.7 Acoustical change.

(a) * * *

(2) If the airplane is a Stage 2 airplane prior to the change in type design, the following apply:

(i) For airplanes for which application for an acoustical change approval is made before (the date of the publication of this notice), the airplane may not be a Stage 1 airplane after the change in type design, and compliance must be shown using the applicable power or thrust, speed, and configuration prescribed in Appendix C of this part.

(ii) For airplanes whose engines have bypass ratio of 2 or less and for which application for an acoustical change approval is made on or after (the date the publication of this notice), the takeoff, sideline, and approach noise levels of the airplane may not exceed the applicable Stage 2 noise limit. Compliance must be shown with noise levels measured and evaluated as prescribed in Appendices A and B of this part, and using the applicable power or thrust, speed, and configuration prescribed in Appendix C of this part.

(iii) For airplanes whose engines have bypass ratios greater than 2 and for which application for an acoustical change approval is made on or after (the date of the publication of this notice), the takeoff, sideline, and approach noise levels of the airplane may not exceed the applicable Stage 3 noise limit by more than 3 EPNdB, or the applicable Stage 2 noise limit, whichever is lower. Compliance must be shown with noise levels measured and evaluated as prescribed in Appendices A and B of this part. In addition, compliance with paragraphs (a)(1)(i) through (iii) of this section must be shown in determining the takeoff and sideline noise levels. The applicable power or thrust, speed, and configuration prescribed in Appendix C of this part must be used in determining the approach noise level.

B. Appendix C

Appendix C [Amended]

1. Section C 36.3 would be amended as follows:

a. In paragraph (a), by deleting the takeoff noise measuring-point distance "3.5 nautical miles" (21,280 feet) and substituting for it the distance "21,325 feet (6,500 meters)";

b. In paragraph (b), by deleting the approach noise measuring-point distance "1 nautical mile" (6,080 feet) and substituting for it the distance "6,562 feet (2,000 meters)", and

c. In paragraph (c), by deleting the sideline noise measuring-point distance "0.25 nautical miles" (1,520 feet) and substituting for it the distance "1,476 feet (450 meters)."

2. Paragraph (a)(2) of § C36.5 would be revised to read:

Section C36.5 Noise levels—(a) * * *

(2) Stage 3 noise limits are as follows:

(i) For approach, 105 EPNdB for maximum weights of 617,300 pounds (280,000 kg) or more, reduced by 2.33 EPdB per halving of the 617 300 pounds weight down to 98 EPNdB for maximum weights of 77,200 pounds (35,000 kg) and less.

(ii) For sideline, 103 EPNdB for maximum weights of 882,000 pounds (400,000 kg)

or more, reduced by 2.56 EPNdB per halving of the 882,000 pounds weight down to 94 EPNdB for maximum weights of 77,200 pounds (35,000 kg) and less.

(iii) For takeoff for airplanes with 4 engines, 106 EPNdB for maximum weights of 850,000 pounds (385,000 kg) or more, reduced by 4 EPNdB per halving of the 850,000 pounds weight down to 89 EPNdB for maximum weight of 44,673 pounds (20,263 kg) and less.

(iv) For takeoff for airplanes with 3 engines, 104 EPNdB for maximum weights of 850,000 pounds (385,000 kg) or more, reduced by 4 EPNdB per halving of the 850,000 pounds weight down to 89 EPNdB for maximum weights of 63,177 pounds (28,657 kg) and less.

(v) For takeoff for airplanes with 1 or 2 engines, 101 EPNdB for maximum weights of 850,000 pounds (385,000 kg) or more, reduced by 4 EPNdB per halving of the 850,000 pounds weight down to 89 EPNdB for maximum weights of 106,250 pounds (48,194 kg) and less.

3. Paragraph (b) and (c) of § C36.7 would be revised to read as follows:

Section 36.7 *Takeoff test conditions.* * * *

(b) Takeoff power or thrust must be used from the start of takeoff roll to the point where the aircraft reaches at least the following altitude:

(i) For one or two-engine powered aircraft, 984 feet (300 meters).

(ii) For three-engine powered aircraft, 853 feet (260 meters).

(iii) For four-engine powered aircraft, 689 feet (210 meters).

(c) Upon reaching the altitude specified in paragraph (b) of this section, the power or thrust may not be reduced below that power or thrust that will provide level flight with one engine inoperative or a four percent gradient, whichever is greater.

The Federal Aviation Administration has determined that this document does not contain a major proposal requiring preparation of an inflation Impact Statement under Executive Order 11821 and OMB Circular A–102.

Issued in Washington, D.C., on October 21, 1976.

CHARLES R. FOSTER,
Director of Environmental Quality.

[FR Doc.76–31463 Filed 10–27–76;8:45 am]

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

[Docket No. 16231; Reference Notice No. 76-22]

NOISE LEVELS FOR TURBOJET POWERED AIRPLANES AND FOR TRANSPORT CATEGORY LARGE AIRPLANES

Public Hearing

The Federal Aviation Administration will hold a public hearing December 14, 1976, on proposed amendments to the Federal Aviation Regulations (14 CFR Chapter I) submitted to the FAA by the Environmental Protection Agency (EPA) under Section 611(c)(1) of the Federal Aviation Act of 1958, as amended by the Noise Control Act of 1972 (Pub. L. 92-574). This hearing will afford interested persons the opportunity to present views, data, and arguments regarding the substance and issues raised in the proposals contained in Notice 76-22 "Noise Levels for Turbojet Powered Airplanes and for Transport Category Large Airplanes" (published elsewhere in Part II of this issue of the FEDERAL REGISTER).

The hearing will be conducted in the Auditorium on the 3rd Floor of the Federal Administration Building, 800 Independence Avenue, SW., Washington, D.C., convening at 9:00 a.m. In the event that response to this notice exceeds the time allotted to the hearing, it will be continued at 9:00 a.m., December 15, 1976, in the FAA Auditorium.

The hearings will be informal in nature and will be conducted by a designated representative of the Administrator under 14 CFR 11.33. At the hearing, FAA spokesmen will make a brief opening statement regarding the proposals contained in the notice. Since the hearings will not be evidentiary or judicial in nature, there will be no cross-examination or other adjudicatory procedure applied to the presentations. However, interested persons wishing to make rebuttal statements will be given an opportunity to do so at the conclusion of the presentations in the same order in which initial statements are made.

Interested persons are invited to attend the hearings and to participate by making oral or written statements concerning the respective proposals. Written statements should be submitted in duplicate and will be made a part of the regulatory docket. Persons wishing to make oral statements at the hearings must notify the FAA that they desire to be heard, and indicate the amount of time requested for their initial statements. Presentations will be scheduled on a first-come-first-served basis, as time may permit. Requests to be heard should be addressed: "Public Hearing on Notice No. 76-22, Attention: Technical and Regulatory Division (AEQ-200), Office of Environmental Quality, Federal Aviation Administration, 800 Independence Avenue, SW., Washington, D.C. 20591;" or telephone: (202) 425-9468.

In addition to material presented for the purpose of the hearings, persons not participating in the hearings are invited to submit relevant written comments to the regulatory docket established for the notice of proposed rule making. As stated in the notice, such written comments should identify the notice or docket number and be submitted in duplicate to: Federal Aviation Administration, Office of the Chief Counsel, Attention: Rules Docket, AGC-24, 800 Independence Avenue, SW., Washington, D.C. 20591. The closing date for submitting written comments is February 28, 1977. All comments will be available for examination in the FAA Rules Docket both before and after the closing date for comments.

Notice No. 76-22 was issued by the FAA in accordance with section 611(c)(1) of the Federal Aviation Act of 1958, as amended by the Noise Control Act of 1972 (Pub. L. 92-574). The notice contains recommended regulations submitted to the FAA by EPA to provide such control and abatement of aircraft noise as EPA determines is necessary to protect the public health and welfare. The notice presents EPA's analysis of the background of the respective proposals and contains the material that is the subject of the public hearings. While all relevant comments are of interest, the FAA specifically invites relevant statements or comments concerning the following:

(a) Available data relating to aircraft noise, including the results of research, development, testing, and related evaluation activities.

(b) The views and positions of other Federal, State, and interstate agencies.

(c) Whether the proposed regulations would be consistent with the highest degree of safety in air commerce and air transportation in the public interest.

(d) Whether the proposed regulations would be—

(1) economically reasonable;

(2) technologically practicable; and

(3) appropriate for the particular types of aircraft, aircraft engines, appliances, or certificates to which they would apply.

(e) The extent to which the proposed regulations would contribute to providing protection to the public health and welfare by carrying out the purposes of section 611 of the Federal Aviation Act of 1958, as amended.

(f) The overall environmental impacts of the proposed regulations (including environmental factors other than noise).

(g) The economic (inflationary) impact that might result because of adoption of the proposed rules.

Before taking further action under section 611(c) of the Federal Aviation Act of 1958, the FAA will consider all statements presented at the hearings and all written statements and comments submitted to the regulatory docket. The specific terms and substance of proposals contained in the notice may be changed in the light of those statements and comments presented.

Transcripts of the hearings will be made and anyone may purchase copies from the reporter. A transcript of each hearing will be available for examination in the Rules Docket.

(Secs. 313(a), 601, 603 and 611(c) of the Federal Aviation Act of 1958, as amended (49 U.S.C. 1348, 1354(a), 1421 and 1431(c)); sec. 6(c) of the Department of Transportation Act (49 U.S.C. 1655(c)); and 44 U.S.C. 1508.)

CHARLES R. FOSTER,
Director of Environmental Quality.

[FR Doc.76-31465 Filed 10-27-76;8:45 am]